ENVIRONMENTAL ASSESSMENT

OAKLAND INNER HARBOR 38-FOOT SEPARABLE ELEMENT OF THE OAKLAND HARBOR NAVIGATION IMPROVEMENT PROJECT

ALAMEDA COUNTY, CALIFORNIA

U.S. Army Corps of Engineers
San Francisco District
211 Main Street
San Francisco, California 94105-1905

April 1992

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1.0 AUTHORIZATION; BACKGROUND INFORMATION; PURPOSE AND NEED FOR THE PROPOSED ACTION; AND PROJECT DESCRIPTION.

1.1 Authorization.

1.1.1 The Water Resources Development Act (WRDA) of 1986, Public Law 99-662, authorized construction of navigation channel improvements to Oakland Inner Harbor and Oakland Outer Harbor. Specifically authorized was the deepening of the Oakland Inner and Outer Harbor channels to -42 feet mean lower low water (MLLW). Also, authorized for the Inner Harbor was: channel widening at the entrance, Mile 3, and at the project terminus; and construction of a 1,200-foot diameter turning basin. Construction authorization for the Oakland Outer Harbor also included: channel widening along the south side of the entrance channel, at the apex of the bend between the Bar and the entrance channel, and at Mile 2.25; and relocation of the existing turning basin. Since authorization, the Oakland Inner Harbor and Oakland Outer Harbor projects have been combined and are referred to as the Oakland Harbor Navigation Improvement Project.

1.2 Background Information.

1.2.1 Oakland Harbor, located on the east side of San Francisco Bay in Alameda County, California (reference Figure 1), consists of an Outer Harbor, a Middle Harbor, and an Inner Harbor (reference Figure 2). The entrance channel to these three harbors is known as the Bar channel. The existing authorized Federal channel is maintained at -35 feet MLLW and provides access to the Port of Oakland's berth areas, which serve container, conventional, and roll-on/roll-off deep-draft vessels. The existing Oakland Inner and Outer Harbor channels are inadequate to efficiently and cost-effectively accommodate modern deep-draft vessels. The specific planning objectives for the Oakland Harbor Navigation Improvement Project are: to reduce delays of containership vessel movements due to tides; to realize increased economies of scale for waterborne commerce; and to increase navigation safety and efficiency of vessel movement in the harbors.

Environmental documentation for the authorized Oakland Harbor Navigation Improvement Project is contained in the Final Feasibility Study and Environmental Impact Statement Oakland Inner Harbor, California, Deep-Draft Navigation and the Final Environmental Statement, Oakland Outer Harbor California Navigation Improvements, Alameda County, California. These final environmental impact statements (EIS) were filed with the Environmental Protection Agency (EPA) in April, 1985 and February, 1981, respectively, and are available for review at the Corps of Engineers, San Francisco District office (211 Main St., San Francisco, CA 94105-1905). The EISs evaluated the environmental impacts of dredging an estimated total of 9,400,000 cubic yards (cys) (4,400,000 cys from the Inner Harbor channel and 5,000,000 cys from the Outer Harbor channel) of material, with disposal of the dredged sediment at the designated Alcatraz aquatic site in San Francisco Bay.

1.2.2 Subsequent to the WRDA of 1986, the proposed disposal of an estimated 9,400,000 cys of dredged material at the Alcatraz aquatic site became a concern, due to the accumulation of dredged sediment at the Alcatraz site. Disposal of dredged sediment from the Oakland Harbor Navigation Improvement Project at Alcatraz could potentially reduce the disposal site capacity and adversely impact continued use of the site for disposal of maintenance dredged material from Bay area harbors, berths, and marinas. In response to these concerns, the Corps of Engineers filed with EPA in March, 1988 a Final Supplement Number 1 To The Environmental Impact Statements (SEIS), Oakland Outer and Oakland Inner Harbors Deep-Draft Navigation Improvements, Alameda County, California. The Oakland Harbor Navigation Improvement Project addressed in the SEIS considered dredging an estimated total 7,000,000 cys of material from the Inner and Outer Harbor channels (Note: the estimated dredging quantity was reduced from 9,400,000 cys to 7,000,000 cys due to the development of a more detailed level channel design based on ship simulation studies). The SEIS evaluated alternative dredged material disposal sites and methods, which were either not considered in detail or not considered at all in the previous Oakland Inner and Outer Harbor EIS's. Specifically, the SEIS considered upland disposal sites, including marsh restoration, other in-Bay disposal sites, historic ocean disposal sites, and candidate (i.e. new) ocean disposal sites. Alternative dredged material disposal sites considered in detail in the SEIS included unrestricted disposal at Alcatraz, Alcatraz disposal with pre-dredging to candidate ocean site 1M, direct ocean disposal to candidate site 1M, and direct disposal to candidate ocean site B1.

1.2.3 The Oakland Harbor Project May 4, 1988 Record of Decision (ROD) on the FSEIS (COE 1988) limited construction to only the "initial phase" of the Oakland Harbor Navigation

Improvement Project; i.e., deepening the Oakland Inner Harbor channel from -35 feet MLLW to -38 feet MLLW and constructing a turning basin 1,100 feet in diameter at -38 feet MLLW. This initial phase would result in disposal of an estimated 500,000 cys of dredged material at an ocean site called B1B (approved for use by EPA on May 3, 1988), located in the vicinity of ocean site B1, approximately 38 nautical miles haul distance from Oakland Harbor. Any dredged material determined to be unsuitable for unrestricted ocean disposal would be placed at an approved upland disposal site. The ROD limited construction because of the immediate need for the Port of Oakland to accommodate larger vessels, and a long-term need to more fully assess environmental issues with the authorized Oakland Harbor Navigation Improvement Project (i.e., deepening the channels to -42 feet MLLW).

1.2.3 In an effort to expedite construction, and to coordinate with the preparation of the FSEIS and ROD, the Port of Oakland, as the non-Federal project sponsor, prepared a Final Environmental Impact Report (EIR) on the Oakland Harbor Navigation Improvement Project, which was certified on March 15, 1988. The Port of Oakland (under a Section 215, of PL 90-483, agreement with the Department of the Army) began construction of the "initial phase" (i.e., deepening the Oakland Inner Harbor channel to -38 feet MLLW and construction of a turning basin) of the Oakland Harbor Navigation Improvement project in May, 1988. However, litigation concerning the use of the B1B ocean dredged material disposal site stopped the dredging project. The Port of Oakland then began investigating the use of upland sites for placement of dredged material from the Inner Harbor channel. The Port of Oakland prepared a Phase I: Oakland Inner Harbor Deep-Draft Navigation Improvement Project, Alameda, Sacramento, San Joaquin Counties, Final Supplemental Impact Report in July, 1989. This document evaluated the environmental effects of dredged material placement on the inside of levees, for levee reinforcement purposes, at Twitchell Island and Lower Jones Tract, located in the Sacramento-San Joaquin Delta area. Due to the schedule delays and increased costs required to comply with permit conditions of the Central Valley Regional Water Quality Control Board and counties, the Port of Oakland decided to consider other dredged material disposal alternatives (both land and aquatic) for the initial phase. In April 1991, the Port terminated their attempts to construct the Oakland Inner Harbor 38-foot channel. Throughout the Ports's efforts on the 38-foot project, the Corps of Engineers continued detailed design of the Oakland Harbor Navigation Improvement Project, i.e. Inner and Outer Harbor channel deepening from -35 feet MLLW to -42 feet MLLW.

1.2.5 Subsequently, the U.S. Senate Appropriations

Committee included language in its 30 July 1991 committee report on the 1992 Energy and Water Development Appropriation Bill, Senate Report 102-80, which directed the Secretary of the Army, acting through the Chief of Engineers, to "...immediately undertake (i.e. construction should commence in Fiscal Year 1992) the authorized dredging of the Oakland Inner Harbor to a depth of 38 feet using available funds." and the "...Committee's preference is for disposal at a site known as the 103 site secured by the Department of the Navy for construction of projects authorized for channel dredging at the Alameda Naval Air Station and the Oakland Naval Supply Center." The Committee report further stated that if the Secretary determines "...that disposal at the aforementioned 103 site cannot be completed in time to permit the timely initiation of construction on the deepening of the Oakland Inner Harbor...", then the Secretary is directed to "...dispose of that portion of the dredge material suitable for marine disposal as necessary to conduct such dredging at the currently permitted Alcatraz disposal site; provided, that the disposal of such materials shall be within the volume limits established for the management of the Alcatraz site and will not create significant, additional adverse environmental impacts." For reasons stated in the "Alternatives" section of this Environmental Assessment (EA), the Corps of Engineers has determined that disposal of the Oakland Inner Harbor dredged material at the Department of the Navy 103 candidate ocean site is not a practicable disposal site alternative. Therefore, the Corps of Engineers is now evaluating the suitability of disposing material dredged from the Oakland Inner Harbor channel at the Alcatraz aquatic disposal site.

1.3 Purpose and Need for the Proposed Action.

1.3.1 The purpose of the proposed project is to provide a safe navigation channel of sufficient depth within the Oakland Inner Harbor for modern deep-draft containerships that are currently using, or scheduled to use, the Port of Oakland terminal facilities. The proposed project is titled the "Oakland Inner Harbor 38-foot Separable Element of the Oakland Harbor Navigation Improvement Project", and is also referred to as the "Oakland Inner Harbor Limited 38-foot Channel Deepening Project" in this EA.

1.3.2 The Oakland Inner Harbor channel is maintained to an authorized depth of -35 feet MLLW. This channel depth is inadequate to accommodate the newer generation containerships. These newer vessels include the third generation containerships known as "Panamax", or "C-9" ships, which have an overall length of 860 to 900 feet and a loaded operating draft of 38 feet. Also included are the fourth generation containerships, known as "post Panamax", or C-10 ships, which have an overall length of 900 to 1,050

feet and loaded operating draft of up to 41 feet.

1.3.3 Existing channel depths in the Oakland Inner Harbor require the larger containerships to wait for high tide and carry reduced loads in order to egress the channel safely. In addition, because of their large size, these newer generation ships are difficult to maneuver in the existing channels, especially under conditions of strong flood or ebb tides or severe cross winds. Therefore, the Port's Inner Harbor channel needs to be deepened to safely accommodate the larger vessels.

1.3.4 An Oakland Inner Harbor limited channel depth of -38 feet MLLW would allow for more efficient use of the channel, especially by larger container vessels, as well as improve navigation safety by decreasing the risk of vessel collisions and groundings.

1.3.5 The commercial shipping industry is extremely sensitive to operational efficiencies. Several of the Port of Oakland's existing tenants have newer generation containerships already in service. The American President Lines (APL) currently has eight Panamax and two post-Panamax vessels in service and several more of the large post-Panamax vessels are under construction. Dredging the Inner Harbor channel to -38 feet MLLW would allow the Port to adequately and efficiently serve these ships.

1.3.6 The Port of Oakland ranks among the largest container ports in the United States in terms of container tonnage, terminal acreage, number of containership berths, and number of container cranes. However, over the past decade, the Port of Oakland's position of prominence among the world's ports has declined. A major explanation for this relative decline is the lack of channel depths to accommodate the modern deep-draft containerships. During the 1970's, the largest container vessels had maximum operating drafts of 32 to 33 feet. Most major carrier containerships now have operating drafts over 35 feet, with the largest operating at drafts between 38 feet and 41 feet.

1.3.7 As waterborne commerce continues to increase over time, the existing 35-foot channel depth of Oakland's Inner Harbor serves to constrain containership trade at the Port of Oakland.

1.3.8 The Oakland Inner Harbor existing 35-foot deep channel adversely affected approximately 75 to 100 containership movements in 1991. The primary navigation problem concerns outbound loaded containership movements. The average annual benefits of providing an Inner Harbor limited channel depth of -38 feet MLLW are estimated to be $2,228,000, through reduction in transportation costs. The estimated annual project cost for the limited 38-foot

channel is $182,000.

1.3.9 Deepening the Oakland Inner Harbor channel to -38 feet MLLW is a separate and independent element of the Oakland Harbor Navigation Improvement Project (i.e., deepening the Inner and Outer Harbor channels to -42 feet MLLW) because the limited 38-foot Inner Harbor channel depth would provide measurable National Economic Development (NED) benefits. Containerships would be more able to fully utilize the Inner Harbor terminal facilities by being able to fully load, sail without delays due to tides, and safely navigate the Inner Harbor channel. There are two reasons for the need to construct the proposed project in 1992: 1) the Congressional committee report language (refer to EA paragraph 1.2.5) directed the Corps to "...immediately undertake the authorized dredging..." "...using available funds" (i.e., Fiscal Year 1992); and 2) the scheduled construction period of September and October, 1992 would have the least impact on fishery resources.

1.4 Project Description.

1.4.1 The Oakland Inner Harbor channel provides access to two major container facilities at American President Lines Terminal and the Howard Terminal. The existing channel is 600 feet wide, with lesser widths between the rock banks at the entrance channel, and is presently maintained to an authorized depth of -35 feet MLLW. The proposed project (reference Plates EA-1 through EA-4), scheduled to commence construction in September 1992, would begin at the Seventh Street Terminal and extend approximately 4 miles to the southeastern corner of the Howard Terminal, almost to Jefferson Street. The proposed project would consist of deepening a portion of the existing authorized Oakland Inner Harbor channel from -35 feet MLLW to -38 feet MLLW (with up to one foot of over depth dredging allowance). The proposed project channel lines would follow the existing 35-foot channel lines through the Bar and Entrance channel; then the channel lines would become narrower than the existing 35-foot channel, between the jetties, in order to provide 3 on 1 side slopes and not undermine the jetties. At the APL terminal, the north channel line would shift northward next to the berths, and the south channel line would shift northward, to minimize dredging and avoid material determined to be unsuitable for unconfined aquatic disposal. At the upstream end (i.e., east) of the proposed limited 38-foot project, the south channel line would shift diagonally to the middle of the existing 35-foot channel, in order to provide loaded vessel egress from the Howard Terminal while minimizing dredging (refer to Plates EA-1 through EA-4). The proposed limited 38-foot project does not include channel widening or construction of a turning basin. Further, no terminal berths will require deepening for the limited 38-foot project. The estimated total volume

of material to be dredged from the limited 38-foot channel project is 562,000 cys. Of this, an estimated 541,000 cys, determined to be suitable for unconfined aquatic disposal, would be dredged by self-propelled hopper dredge or clamshell/barge (although the lesser cost of construction favors the self-propelled hopper dredge) and disposed at the designated Alcatraz aquatic disposal site (reference Figure 3). The remaining estimated 21,000 cys, determined to be unsuitable for unconfined aquatic disposal, would be dredged by clamshell, with the dredged material barged to Port Sonoma - Marin (reference Figure 4); offloaded by clamshell and stockpiled at a 16-acre upland drying pond site at Port Sonoma - Marin; and then transported by dump truck to the Redwood Landfill site (refer to Figure 4), located 3.5 miles north of the City of Novato, Marin County, for use as daily cover. Following is a discussion on dredged material suitability/unsuitability for unconfined aquatic disposal as related to the limited 38-foot project.

1.4.2 Based upon a study of the Oakland Inner Harbor sediment samples (reference report titled "Ecological Evaluation of Oakland Harbor Phase III -38-Foot Composites Relative to the Alcatraz Island Environs (R-AM)", dated January 1992), the proposed project dredged material sediment has been separated into two categories; those sediments that have been determined to be suitable for unconfined (or unrestricted) aquatic disposal and those sediments that are unsuitable for unconfined aquatic disposal. Please note that the enclosed Plates EA-2 through EA-4, showing the proposed limited 38-foot Oakland Inner Harbor channel, have been divided into six areas representing sediment sample composites corresponding to the previously mentioned report.

1.4.3 Suitability of sediments for unconfined aquatic disposal has been evaluated through the use of sediment chemistry, biotoxicity tests, and bioaccumulation analyses. After evaluation of the test results, the Corps of Engineers determined that: dredged sediments from Composite areas I through III and most of Composite IV were clearly suitable for unconfined aquatic disposal at Alcatraz; Composite V was marginally suitable for unconfined disposal at Alcatraz; and Composite VI was unsuitable for unconfined aquatic disposal at Alcatraz (Plates EA-2 through EA-4).

1.4.4 The R-AM report was reviewed by, and a two day coordination meeting was conducted with, the following Federal and State regulatory and resource agencies: EPA, National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service, California EPA, the San Francisco Bay Conservation and Development Commission (BCDC), California Department of Fish and Game (CDFG), the San Francisco Bay Regional Water Quality Board (RWQCB), and the Port of Oakland in January 1992. The regulatory and resource

agencies had strong reservations about the Corps' conclusion as to which material was suitable for unconfined aquatic disposal at Alcatraz - specifically regarding Composites III, IV, and V. Debate over these issues would be lengthy with no guarantee that the RWQCB would issue water quality certification for dredging and dredged material disposal in the areas in question. Also, while additional testing might provide conclusive evidence (although there is certainly no guarantee) of suitability for unconfined aquatic disposal for all of the material from Composites III, IV, and V, the time frame to conduct additional tests would adversely impact the environmental windows included in the proposed project construction schedule. For these reasons, the Corps of Engineers modified the project to include: slight realignment of the Inner Harbor channel to the north, in order to reduce dredging quantities and to avoid dredging a portion of Composite area III (Plate EA-4, area labeled "U" surrounding sampling stations I-C29 and I-C30), determined to be unsuitable for unrestricted aquatic disposal; and dredging those portions of Composite areas IV and V (Plate EA-4, areas labeled "U" surrounding sampling stations I-C9, I-C12, I-C13, I-C14, I-C33, and I-C34) that have been determined unsuitable for unrestricted aquatic disposal, and disposing those sediments at an approved upland disposal site (i.e. the Redwood Landfill site).

1.4.5 In summary, the proposed Oakland Inner Harbor limited 38-foot project, scheduled to begin construction in September 1992, would deepen a portion of the existing 35-foot channel from -35 feet MLLW to -38 feet MLLW (with up to one foot of overdredging allowance) and consist of:

(1) dredging an estimated 562,000 cys from the channel beginning at the foot of the Seventh Street Terminal and extending to the southeastern corner of Howard Terminal;

(2) dredged material determined suitable (estimated to be 541,000 cys) for unconfined aquatic disposal would be disposed of at the designated Alcatraz aquatic site;

(3) avoiding dredging a portion of Composite area III (Plate EA-4) labeled unsuitable for unconfined aquatic disposal

(4) clamshell dredging material from portions of Composite areas IV and V (estimated to be 21,000 cys), determined unsuitable for unconfined aquatic disposal, with disposal of the material at the Redwood Landfill site.

(5) the estimated increase in annual maintenance dredging quantity due to the limited 38-foot

project channel is a negligible 3% (7,000 cys as compared to the existing project's average annual maintenance dredging quantity of 250,000 cys).

1.4.6 The proposed Oakland Inner Harbor limited 38-foot project does <u>not</u> include:

(1) construction of a 1,100-foot diameter turning basin;

(2) dredging of berths located along the Inner Harbor channel; all berths along the limited 38-foot project channel are presently maintained at -38 feet MLLW or deeper.

1.4.7 The purpose of this environmental assessment is to evaluate the impacts of a separable element of the Oakland Harbor Navigation Improvement Project, i.e. the proposed Oakland Inner Harbor Limited 38-foot Project, and to determine whether a supplement to the <u>Final Feasibility Study and Environmental Impact Statement, Oakland Inner Harbor, California Deep-Draft Navigation</u>, dated November, 1984, is required.

1.5 <u>Other Related Projects</u>.

1.5.1 Existing Authorized Oakland Inner Harbor Channel. The existing Inner Harbor channel branches easterly from the entrance of the Outer Harbor channel, with the initial 0.5 mile length located in the City of San Francisco. The Inner Harbor channel continues along the common boundary of the Cities of Oakland and Alameda and consists of an improved channel at -35 feet MLLW in depth, and 600 feet to 800 feet wide. Also included are widened channel areas and a turning basin contiguous with the tidal channel at the eastern terminus of the Inner Harbor, parallel rock fill jetties about 1.5 miles in length located near the channel entrance, and a -25 feet MLLW deep channel, 300 feet wide, located on the north side of Government Island. Maintenance dredging of the existing Oakland Inner Harbor channel occurs yearly, by hopper dredge, with disposal of an average annual 250,000 cys of dredged material at the designated Alcatraz aquatic disposal site.

1.5.2 Oakland Harbor Navigation Improvement Project. The Corps of Engineers is currently preparing a Design Memorandum and Draft Supplemental EIS on the Oakland Harbor Navigation Improvement Project (i.e., deepening the Inner and Outer Harbor channels to -42 feet MLLW, reference EA paragraph 1.1). It is important to note that the limited 38-foot Inner Harbor channel deepening project is economically justified on its own merits and completion of the limited 38-foot Inner Harbor channel deepening project does not obligate the Corps, or the Port of Oakland, to

implementation of the 42-foot Oakland Outer and Inner channel deepening project.

2.0 PROJECT ALTERNATIVES; AND DREDGED MATERIAL DISPOSAL SITE ALTERNATIVES.

2.1 Project Alternatives.

2.1.1 No Project. Channel improvements in the Oakland Inner Harbor, including deepening to at least -38 feet MLLW, for safe and efficient operation of deep-draft containerships, is an important element of the San Francisco Bay Area's overall capability to function as a major gateway for U.S. waterborne import/export commerce.

2.1.1.1 If the limited 38-foot Inner Harbor channel deepening project does not occur as proposed, overall transportation costs will be higher than anticipated by the shippers, assuming an in place 38-foot channel. The project economics estimates these costs to be $2,228,000 annually, based on vessel inefficiencies and tidal delays. In addition, the Port anticipates these higher costs to ultimately result in a worsened situation whereby selected ocean carriers would confine service through the Port of Oakland to local destination cargo only. These carriers would re-route both intermodal, discretionary (East of the Mississippi River and Texas) cargo and Prairies cargo through other ports. American President Lines, because of their terminal served by the Inner harbor channel, is included in this category (Port 1992).

2.1.1.2 Because of its extensive, specialized intermodal marine facilities and mainland location as the terminus of three transcontinental railroads, the Port of Oakland has historically handled about nine of every 10 intermodal containers entering and leaving the Golden Gate (Port 1992).

2.1.1.3 Under the no project alternative, in the year 1995, there would be no growth in the Port of Oakland's shipping and it will remain at a level equal to that which currently exists in 1990-1991. More specifically, there would be no growth in maritime operations in 1995 at both the APL Terminal and the Howard Terminal. Under the Port's scenario of an actual loss in tonnage, there would be a regional decline in jobs and income. For example, the Port forecasts that the two terminals would generate 30 fewer jobs, as compared to the current level. Only 1,960 direct and induced jobs with an associated $88,500,000 in personal income (includes re-spending affect) would remain. Related jobs would decrease by 2,200. Maritime operations at the two terminals would experience a loss of $9,700,000 in business revenue and a loss of $124,000 in potential state and local tax revenue (Port 1992).

2.1.2 Proposed Project. The proposed project is scheduled to begin construction in September 1992, and is fully described in EA paragraph 1.4 Project Description.

2.2 Dredged Material Disposal Site Alternatives.

2.2.1 Proposed In-Bay Disposal at Alcatraz. The Alcatraz disposal site (SF11) is located in San Francisco Bay south of Alcatraz Island. Coordinates of the site center are 37° 49' 17" N latitude, 122° 25' 23" W longitude. The site is: circular with a diameter of 2,000 feet and a surface area of 0.11 square miles; and is an unconfined, open water disposal site within a high energy area.

2.2.1.1 Based upon its close proximity to the Golden Gate, the Alcatraz disposal site is located to promote the transport of disposed dredged sediments out of the Bay system and into the ocean; however, a fraction of the dredged material disposed at Alcatraz is retained, and the existing site capacity cannot accommodate continued disposal of dredged sediment indefinitely, without site boundary expansion or removal (i.e., re-dredging) of the retained material. The Corps of Engineers, via monthly bathymetric surveys, monitors and evaluates the physical capacity of the Alcatraz disposal site. In addition, the RWQCB, by their 1990 Resolution No. 90-37, established annual and monthly quantity targets for disposal of dredged material at Alcatraz. Based upon the annual disposal quantity target, the Corps has developed a schedule of estimated monthly dredge quantities for the Alcatraz disposal site, for use by Federal and permitted projects. Specifically for the Alcatraz disposal site, disposal of dredged material is limited to those areas of the site that are at a minimum depth of -60 feet MLLW with monthly quotas of 300,000 cys from May to September and 1,000,000 cys from October to April.

2.2.2 Ocean Disposal. Ocean disposal of dredged material is regulated by the EPA and the Corps under the MPRSA. Under the MPRSA, dredged sediments may only be disposed at ocean sites approved for that use. Currently, there is no ocean site designated for disposal of fine-grained dredged material offshore of San Francisco. The EPA approved B1B ocean site was for the initial phase of the Oakland Harbor Navigation Improvement Project (i.e., deepening the Inner and Outer Harbor channels to -42 feet MLLW). The proposed limited 38-foot project is a complete project in and of itself and not part of a larger project. Therefore, it has been determined that use of the B1B site for the proposed project would require new sediment sampling/testing and EPA approval under Section 103 of the MPRSA. The time required to achieve this EPA approval and considering the unresolved litigation issue regarding Coastal Zone Consistency,

eliminates ocean disposal at B1B as a practicable alternative for the proposed project. One other ocean disposal site exists, but its use is limited to sediments composed of at least 95% sand (Ogden Beeman & Associates 1992) and therefore is not a practicable alternative for the proposed project.

2.2.2.1 The EPA is currently conducting site characterization studies of several ocean sites offshore of San Francisco, under the Long Term Management Strategy (LTMS) to develop sufficient information to identify and designate a permanent, environmentally acceptable disposal site under Section 102 of the MPRSA. Once designated, the selected site will be available for disposal of dredged sediments that have been determined not to degrade the marine environment as specified in the MPRSA, and meet other requirements of the Act. Site designation is scheduled to be completed in January of 1994. Thus, ocean disposal of dredged material at a Section 102 site is not possible within the construction schedule of the proposed Oakland Inner Harbor limited 38-foot project.

2.2.2.2 The U.S. Navy has applied for a Section 103 (MPRSA) permit from the Corps of Engineers, to ocean dispose of dredged material from two San Francisco Bay dredging projects. A Section 103 permit, if issued, would allow the Navy to dispose of sediments for their specific projects at an ocean site that has not been formally designated by the EPA. Issuance of the permit would depend upon the quality of the sediment to be disposed, the ecological characteristics of the proposed ocean disposal site, other requirements of the MPRSA, and the Corps' evaluation of the public interest.

2.2.2.3 The Navy is currently completing characterization studies of a potential deep ocean site approximately 40 nautical miles west of the Golden Gate, in approximately 1,200 fathoms of water. This area was historically used as a chemical and munitions dump site. The EPA has determined that preparation, and approval, of a Supplemental Environmental Impact Statement is required, to describe and evaluate use of this site, before a decision can be made on the Navy's permit application.

2.2.2.4 If the Navy releases a Final Supplemental Environmental Impact Statement which adequately characterizes the proposed ocean site, and the Corps and EPA determine that the site is suitable for dredged material disposal, that site could be used for disposal of sediments from the proposed Oakland Inner Harbor limited 38-foot dredging project, if other requirements of the Act are satisfied, and the Corps determines such an action would be in the public interest. In fact, language included in the committee report for the Congressional Energy and Water

Fiscal Year 1992 Appropriations, directed the Corps to evaluate disposal of the Oakland Harbor sediments at the Navy's proposed Section 103 ocean disposal site. At the time of the Congressional committee report (July, 1991), the Navy indicated that their FSEIS would be completed by February 1992, and a decision on the suitability of the site was expected in the Spring of 1992. Discussions between Congressional staff and the EPA Region IX officials established that EPA would consider use of the site under Section 103 of the MPRSA for Oakland Harbor dredged sediments, if a FSEIS was completed and approved.

2.2.2.5 Since that time, the Navy's SEIS schedule has been delayed several times, and the information on ocean site characterization and evaluation is currently not available for review, nor likely to be available, within the proposed construction schedule of the Oakland Inner Harbor limited 38-foot project.

2.2.2.6 Because the Navy SEIS is not completed or approved, disposal of dredged sediments from the Oakland Inner Harbor limited 38-foot project at the proposed Navy Section 103 site can not be considered at this time.

2.2.3 Upland Disposal of Dredged Material Suitable for Unconfined Aquatic Disposal. The LTMS study effort, BCDC, and the Port of Oakland have evaluated potential upland sites for disposal of dredged sediments that are suitable for aquatic disposal (Tetra Tech, Inc. 1991; BCDC 1992). More than 30 potential upland sites have been evaluated to determine if dredged material could be used for levee reinforcement, wetland restoration, fill, or as capping material or daily cover at a landfill. None of the upland alternatives are considered feasible for disposal of all the material at this time. The main factors constraining the feasibility of upland dredged material disposal are implementation cost and funding limitations, site availability and capacity, engineering feasibility, and regulatory acceptability.

2.2.3.1 For example, in 1989, the Port of Oakland proposed disposal of dredged sediments from the Inner Harbor deepening project behind levees on Twitchell Island in Sacramento County, and Lower Jones Tract in San Joaquin County (Port 1989). That proposal was abandoned due to the anticipated costs of complying with permit discharge monitoring requirements of the Central Valley Regional Water Quality Control Board, and additional permit requirements from the local jurisdictions.

2.2.3.2 The primary factors affecting the feasibility of upland dredged material disposal in the present case are site availability and cost. Under procedures specified in the Corps of Engineers regulations (33 CFR 336) for projects

involving the discharge of dredged material into waters of the U.S., the local sponsor of a Corps project, in this case the Port of Oakland, is financially responsible for elements of the project whose costs exceed the Federal standard. The least costly alternative, consistent with sound engineering practices and selected through application of the Section 404(b)(1) Guidelines is designated as the Federal Standard. In the present case, the Corps has determined the Federal standard to be the proposed Alcatraz disposal project (reference EA paragraph 1.4). Thus, the local sponsor is responsible for all costs in excess of that required for Alcatraz disposal of suitable sediments, and upland disposal of those sediments that are unsuitable for unconfined aquatic disposal.

2.2.3.3 The Sonoma Baylands site in Sonoma County is only in the initial permitting phase for a wetland restoration project. To accommodate dredged material from the Oakland Inner Harbor channel, the project would need to be designed to accommodate 541,000 cys, as well as on-site utility relocations accomplished by the permit applicant. The earliest this permit approval and work can be expected is early 1993, which is beyond the schedule of the proposed project. Moreover, even if the Sonoma Baylands wetland restoration project receives all regulatory approvals by the time the Oakland dredging project commences construction, and the wetland restoration project sponsors agree to accept the Oakland dredged material, the Port of Oakland would be financially unable to fund the cost difference between the proposed project and the wetland restoration option. The estimated project construction cost difference between the proposed project and disposal of the suitable portion of the project sediments (i.e., 541,000 cys) at the Sonoma Baylands site, is $5,650,000. Thus, this alternative is not considered practicable or feasible for the proposed project.

2.2.3.4 Also, considered was disposal of all of the Oakland Harbor dredged material at the drying facility at Port Sonoma - Marin, with ultimate use of the sediments, once dry, at Redwood Landfill, for use as daily cover. (Barge transport of wet dredged sediments to Redwood Landfill directly is not possible without dredging an access channel through sensitive habitats). However, this alternative is not practicable because of the limited capacity of the drying site at Port Sonoma - Marin. The drying ponds at Port Sonoma - Marin can accommodate up to 150,000 cys of sediment at a time, but that capacity is limited by the drying of sediments dredged regularly from Port Sonoma - Marin (approximately 50,000 cys annually) and the rate at which the sediments dry, and are transported by truck off-site. Additionally, this alternative would be constrained by the same non-Federal funding restrictions as Sonoma Baylands. The estimated project construction cost difference between the proposed project and disposal of all

the dredged sediments at Port Sonoma - Marin/Redwood Landfill is much greater than the $5,650,000 cost difference for the Sonoma Baylands site alternative. Since the Port of Oakland is financially unable to assume the cost difference between the proposed project and the wetland restoration alternative, the Port certainly would not be able to assume the cost difference for the Port Sonoma - Marin/Redwood Landfill alternative. Thus, disposal of all the sediments at Redwood Landfill, after drying at the Port Sonoma - Marin ponds, is not a practicable or feasible disposal option for the limited 38-foot project.

2.2.4. Upland Disposal of Dredged Material Unsuitable for Unconfined Aquatic Disposal. A number of upland locations (including four sites on Port of Oakland property - the 9th Avenue Terminal, Berth 30 Terminal, Berths 8 & 9 Terminals, and the Galbraith Golf Course) were also evaluated for disposal of that portion of the sediments that are considered unsuitable for unconfined aquatic disposal. Of the options considered, the Port Sonoma - Marin/Redwood Landfill alternative is the most practicable, since these sites have previously been used for this purpose, and the proposed activities are already permitted at these locations. Additionally, the proposed project would provide a beneficial use of the dredged material, by supplying daily cover material for an existing landfill.

3.0 ENVIRONMENTAL DOCUMENTS. Environmental documents incorporated into this Environmental Assessment, by reference, are listed in the Reference section at the end of the EA.

4.0 AFFECTED ENVIRONMENT.

4.1 Introduction.

4.1.1 San Francisco Bay is an urbanized estuary connected to the Pacific Ocean by an approximate one mile wide natural opening called the Golden Gate. The primary fresh water inflow into the estuary is from the Sacramento and San Joaquin Rivers, which drain the entire California Central Valley. It is estimated that the 17,000,000 acre-feet of inflow to the estuary carries 10,000,000 cys of sediment into San Francisco Bay annually from these and other natural runoff sources (COE 1988). Mixed and semidiurnal tides oscillate flow between the estuary and the ocean.

4.1.2 The Bay Area is one of the major metropolitan centers on the west coast of the United States with an estimated population of over 6,000,000 people. The primary commercial shipping centers are Oakland, San Francisco, and Richmond - all of which have direct access to the Pacific Ocean

shipping lanes via the San Francisco Bay and the Golden Gate. In the last twenty years the Port of Oakland has been the Bay area leader in movement of container cargo and as such, has become a major factor in the economy of the area.

4.2 <u>Oakland Inner Harbor</u>.

4.2.1 The Port of Oakland is a central point in Pacific rim trade. The Oakland Inner Harbor is located on the eastern side of San Francisco Bay, about 8 miles southeast of the Golden Gate Bridge. The Port of Oakland and its harbor facilities, situated on the northern side of the Oakland Inner Harbor Channel, handle the majority of cargo tonnage of the 15 ports of entry areas in the San Francisco Bay Area Customs District.

4.2.2 <u>Sediment and Water Quality</u>.

4.2.2.1 <u>Sediment Quality</u>. Following is a summary of the sediment sampling, testing, and test results which were conducted by Battelle/Marine Sciences Laboratory under contract to the Corps of Engineers. Battelle's report titled "Ecological Evaluation of Oakland Harbor Phase III -38-Foot Composites Relative to the Alcatraz Environs (R-AM)", January, 1992, details the sediment sampling of the Oakland Inner Harbor limited 38-foot project channel, chemical analysis of the sediment, and biological testing of the sediment. Six Oakland Inner Harbor channel composite sediment samples (COMPs) (refer to Figure 2) were compared to reference sediment from the area surrounding Alcatraz Island and the dredged material disposal site (refer to Figure 3). The reference area was designated the Alcatraz Island Environs (R-AM). The Battelle report has been provided to the appropriate Federal and State regulatory agencies (refer to EA paragraph 1.4) and is also available for review at the Corps of Engineers, San Francisco District office (Room 918, 211 Main Street, San Francisco, CA 94105-1905).

4.2.2.2 Sediment core samples were collected from 29 stations (designated as I-C3 through I-C35, reference Plates EA-2 through EA-4) representing potential dredging areas in Oakland Inner Harbor. Physical and chemical analyses were conducted on the individual sediment samples from each station. These physical and chemical analyses of the sediment samples consisted of grain size, total volatile solids (TVS), total organic carbon (TOC), oil and grease, total petroleum hydrocarbons (TPH), 10 metals, 17 polynuclear aromatic hydrocarbons (PAHs), 20 chlorinated pesticides, 7 polychlorinated biphenyls (PCBs), and 3 butyltin compounds. Samples of sediments from the same stations were also composited into six composites (COMPS I through VI, reference Plates EA-2 through EA-4) for purposes of biological testing. The same physical and chemical

analyses were performed on the composites.

4.2.2.3 Sediment Geology. The geologic units comprising the 29 sediment cores sampled were Merritt Sand, Older Bay Mud (OBM) and Younger Bay Mud (YBM). The OBM is distinguished by its firm-to-hard consistency and its color, which often consists of various shades of red, yellow, and brown. These colors indicate an oxidizing environment. Deposits, with grain sizes ranging from loose sands to hard, stiff, silty clays, can be found in the OBM. Merritt Sands are frequently found beneath YBM and are characterized by highly compacted sediment, mainly medium sized sand particles, with up to 30% silt and clay. The vertical positions within the sediment column, and the weathered and bleached appearance of the OBM suggests that this sediment is much older than the relatively recent estuarine sediments belonging to YBM. Data showed that OBM and Merritt Sand were not present in core samples from stations contributing to COMP I and were present in only one sample (I-C27) that contributed to COMP II. The OBM and Merritt Sands represented approximately 38% of the sediment from core samples contributing to COMPs III, IV, V, and VI.

4.2.2.4 The YBM consists of mostly soft, dark-colored sediments, deposited in an estuarine environment. This layer consists mostly of silty clays, with portions of fine sand. The YBM colors ranged from dark olive gray to black, and often had a hydrogen sulfide odor, which is an indicator of chemically reducing conditions. The YBM generally has a very soft consistency, unlike OBM and Merritt Sands. Sediment samples that contributed to COMP I and COMP II (except for I-C27) were entirely YBM and were located in the upper 2 to 5 feet of sediment from the outer and middle areas of Oakland Inner Harbor. The YBM unit from cores in COMPs III, IV, V, and VI was generally within the upper 3 feet of the sediment column, and overlaid the OBM and Merritt Sand.

4.2.2.5 Sediment Chemistry. Conventional sediment measurements are grain size, TOC, TVS, oil and grease, and TPH. Grain size, TOC and TVS are expressed as percent dry weight of the sample. Oil and grease, TPH, and metal concentrations are expressed as milligrams per kilogram (mg/kg, or parts per million (ppm)) dry weight. PAHs and butyltins are expressed as micrograms per kilogram (ug/kg, or parts per billion (ppb)) dry weight.

4.2.2.6 The grain size test results show that Oakland Inner Harbor channel sediments are composed of a mixture of sediment grain sizes within each COMP. The individual samples within COMP I, show a predominantly coarse-grained sediment distribution (between 35% and 70% sand or coarser), while the composite sample had approximately equal percentages of sand, silt and clay. COMP II, and its

respective individual samples, showed a significant amount of fine-grained sediments, with 10% or less sand, except for the 32% in sample I-C27, which had approximately equal distributions of sand, silt, and clay fractions. COMP III and the individual sample from Station I-C29 contained approximately equal amounts of sand, silt and clay fractions, while samples from Stations I-C8, I-C28, I-C28 dup, and I-C30 were composed primarily (50% to 70%) of sandy sediments. COMP IV, and its respective core stations, showed five samples containing predominantly (55% to 80% sand) coarse-grained sediments (COMP IV and Stations I-C10, I-C11, I-C31, and I-C33) and predominately (5% to 25% sand) fine-grained sediments for 4 stations (I-C9, I-C12, I-C32, and I-C34). COMP V, and its respective individual samples, are composed primarily (50% to 70% sand) of coarse-grained sediments. COMP VI, and its individual samples, are essentially fine-grained sediments (15% to 40% sand), with the exception of the 72% sand at Station I-C16.

4.2.2.7 Table 1 presents a summary of COMP I through COMP VI, and their respective individual sediment samples, test results for grain size, TOC, TVS, oil and grease, and TPH. Table 2 presents the butyltin and PAH test results, and Table 3 presents the metals test results. The PAHs consist of 6 low molecular weight PAHs (LPAH) and 11 high molecular weight PAHs (HPAH). The PAHs in Oakland Inner Harbor sediments are predominantly (85% to 95%) HPAH. Eight of the 20 chlorinated pesticide compounds had at least one value above detection limits in the Oakland Inner Harbor sediment. Only 4,4'-DDD, 4,4'-DDE, and Dieldrin occurred in more than one sample. Except for 4,4'DDE, which averaged <25.0 ppb (dry weight) in COMP I and Dieldrin which averaged <3.0 ppb in COMP V, the concentrations of the pesticide compounds in the COMP sediments were all below detection limits, which varied from 2.7 to 4.3 ppb. Aroclor-1254 was the only of 7 PCBs that had values above the detection limit. Only COMPs I, II, and IV had values above the detection limits and these values were, respectively, 54.5, 87 and 64 ppb.

4.2.2.8 Water Quality. In general, water quality values are lower in the Oakland Inner Harbor when compared to similar values in the open Bay. Poor circulation, plus storm sewer releases, and seasonal and diurnal temperature fluctuations affect water quality. Relative turbidity is low in the Inner Harbor.

TABLE 1

OAKLAND INNER HARBOR LIMITED 38-FOOT PROJECT

Conventional Sediment Measurements Results (grain size, TOC and TVS in percent dry weight; Oil and Grease and TPH in mg/kg dry weight).

Sediment Treatment	Gravel >2000um	Sand 62.5–2000um	Silt 3.9–62.5um	Clay <3.9um	TOC	TVS	Oil and Grease	TPH
COMP I	0	32	32	36	0.88	7.01	105	87
COMP I duplicate	0	31	32	37	0.36	7.94	89	75
I-C 3	0	49	22	29	0.61	5.60	48	37
I-C19	21	13	29	37	0.61	8.75	18	17
I-C21	0	68	15	17	0.32	3.52	47	18
COMP II	0	8	44	48	1.14	8.77	69	59
I-C 5	0	7	43	50	1.13	9.48	111	68
I-C22	0	11	43	46	1.05	9.30	78	58
I-C23	0	9	46	45	1.12	8.96	79	43
I-C24	0	8	45	47	1.05	9.02	77	40
I-C25	0	6	43	51	1.19	8.90	146	121
I-C25 top 12"	0	10	53	37	1.35	10.60	128	81
I-C26	0	8	45	47	1.13	9.06	16	62
I-C27	0	32	33	35	0.81	5.69	57	29
COMP III	0	38	29	33	0.90	5.95	202	167
I-C 8	0	70	15	15	0.21	2.63	33	12
I-C28	0	51	23	26	0.56	4.94	125	97
I-C29	0	29	31	40	1.01	6.25	245	181
I-C30	0	55	19	26	0.60	4.67	14	0.8U
COMP IV	0	53	19	28	0.61	5.06	74	49
I-C 9	0	26	31	43	1.03	7.50	175	142
I-C10	0	79	8	13	0.22	2.63	21	18
I-C11	0	76	10	14	0.24	2.76	49	36
I-C12	0	14	34	52	1.15	8.67	100	93
I-C31	0	63	14	23	0.45	4.38	53	47
I-C32	0	5	38	57	1.31	10.01	158	124
I-C33	0	65	14	21	0.43	3.74	57	42
I-C34	0	26	28	46	0.99	9.42	90	48
COMP V	0	65	18	17	0.22	2.99	58	36
I-C13	0	71	11	18	0.34	3.49	66	59
I-C14	0	56	17	27	0.51	4.40	82	65
I-C15	1	62	20	17	0.20	2.84	29	20
I-C18	1	52	24	23	0.44	3.75	135	102
COMP VI	0	41	32	27	0.36	3.96	58	51
I-C16	0	72	11	17	0.31	3.24	56	46
I-C17	0	17	32	51	1.25	8.46	188	145
I-C35	0	30	32	38	0.76	5.96	142	112
R-AM	4	94	1	1	0.07	2.13	13	0.6U

U = Undetected above given detection limit.

TABLE 2
OAKLAND INNER HARBOR LIMITED 38-FOOT PROJECT
Butyltins and Total Polynuclear Aromatic Hydrocarbons (PAHs) Found in Sediment Treatments (ug/kg dry weight)

	PAHs Above Detection Limit			Butyltin Species		
Sediment Treatment	Total Low Molecular Weight PAH	Total High Molecular Weight PAH	Total PAH	Tri-butyl	Di-butyl	Mono-butyl
COMP I	160.75	1842.79	2003.54	8.2	2.7	1.0
COMP I duplicate	138.22	1364.66	1502.88	3.8	1.8	0.7
I-C 3	72.40	831.44	903.84	3.5	2.0	0.6
I-C19	48.37	532.89	581.26	2.4	1.2	0.6U
I-C21	51.35	368.49	419.84	9.6	3.3	0.6U
COMP II	151.43	2104.24	2255.67	9.1	4.6	1.1
I-C 5	149.94	1492.82	1642.76	11.1	4.5	1.3
I-C22	160.19	1688.86	1849.05	6.7	3.6	1.3
I-C23	150.39	1685.41	1835.80	10.6	3.3	0.5
I-C24	120.30	1316.69	1436.99	11.6	5.3	1.3
I-C25	145.64	2200.95	2346.59	11.8	6.3	1.4
I-C25 top 12", Rep 1	263.67	2011.36	2275.03	16.3	10.4	1.7
I-C25 top 12", Rep 2	301.93	2371.54	2673.47			
I-C26	197.21	2100.33	2297.54	13.1	4.9	1.3
I-C27	51.98	831.27	883.25	9.9	11.0	1.1
COMP III	303.07	4646.80	4949.87	30.7	21.9	3.0
I-C 8	58.58	631.26	689.84	12.7	5.0	0.5
I-C28	70.16	1233.32	1303.48	15.3	9.0	1.7
I-C28 duplicate	97.52	1379.65	1477.17	9.5	7.0	2.2
I-C29	223.25	3507.68	3730.93	35.0	18.9	5.8
I-C30	221.17	2415.38	2636.54	33.4	17.2	2.6
COMP IV	165.83	2654.61	2820.44	16.8	12.5	2.5
I-C 9	184.34	3509.61	3693.95	33.6	21.9	3.8
I-C10	44.01	700.45	744.46	6.4	3.4	0.6
I-C11	52.41	555.91	608.32	5.0	3.0	0.4U
I-C12	368.91	6407.70	6776.61	26.6	24.1	3.7
I-C31	102.48	1440.09	1542.57	8.0	5.2	0.7
I-C32	163.93	4016.86	4180.79	34.9	15.6	3.3
I-C33	119.53	1411.43	1530.96	19.9	14.8	2.4
I-C34	262.48	4024.96	4287.44	32.8	18.6	1.8
COMP V	182.73	1551.09	1733.82	17.2	7.8	1.5
I-C13	180.49	3347.39	3527.88	7.0	6.3	1.7
I-C14	130.88	2250.48	2381.37	9.2	9.1	1.4
I-C15	79.59	3511.70	3591.29	3.7	2.6	0.5
I-C18	100.05	2166.33	2266.38	14.4	14.7	2.8
COMP VI	170.30	2971.12	3141.42	7.9	6.5	1.5
I-C16	113.75	1867.66	1981.41	6.5	5.4	0.5
I-C17	625.01	7284.23	7909.24	44.5	40.1	3.4
I-C35 top 12"	464.09	31415.66	31879.75			
I-C35	282.31	5536.81	5819.12	38.8	17.4	3.2
R-AM	45.57	72.77	118.34	1.0	0.6	0.4U

U = Undetected above given concentration.

TABLE 3
OAKLAND INNER HARBOR LIMITED 38-FOOT PROJECT
Sediment Metals Results

Sediment Treatment	Metals (mg/kg dry weight)									
	Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
COMP I	0.26	9.30	0.25	235	44.4	0.275	87.8	26.5	0.18	111.6
COMP I duplicate	0.30	9.40	0.24	335	174.3	0.314	86.0	24.9	0.18	135.5
I-C 3	0.22	8.37	0.15	363	37.2	0.227	75.2	22.1	0.13	98.1
I-C19	0.19	8.60	0.23	186	49.5	0.116	96.5	14.5	0.26	95.8
I-C21	0.13	6.12	0.10	375	26.0	0.248	57.3	14.5	0.08U	59.8
COMP II	0.36	9.50	0.28	251	54.9	0.358	100.5	57.1	0.27	146.9
I-C 5	0.40	11.00	0.23	201	55.5	0.374	105.9	36.9	0.21	146.5
I-C22	0.39	12.00	0.20	215	57.4	0.370	104.5	32.5	0.30	133.8
I-C23	0.40	10.70	0.24	224	54.8	0.298	103.6	32.9	0.29	139.0
I-C24 Rep 1	0.38	11.90	0.28	209	54.1	0.337	97.6	32.2	0.23	139.5
I-C24 Rep 2	0.40	10.70	0.25	198	56.9	0.337	104.9	34.4	0.27	139.9
I-C24 Rep 3	0.36	NT	0.22	NT	NT	0.364	NT	NT	0.26	NT
I-C25	0.44	9.70	0.27	219	62.2	0.424	108.6	38.9	0.18	152.6
I-C25 top 12"	0.42	9.70	0.21	207	60.6	0.374	105.3	34.6	0.34	143.9
I-C26	0.42	12.10	0.23	188	59.1	0.390	99.4	34.9	0.29	147.9
I-C27	0.30	10.10	0.25	240	46.5	0.281	94.9	28.5	0.09	119.4
COMP III	0.55	11.60	0.59	284	60.3	0.521	90.4	41.9	0.18	144.2
I-C 8	0.10	4.96	0.11	263	23.1	0.085	58.8	12.0	0.08U	59.6
I-C28	0.41	8.80	0.42	351	47.2	0.372	85.6	32.9	0.09	112.4
I-C28 duplicate	0.43	7.00	0.43	431	44.2	0.345	88.0	33.1	0.08U	115.6
I-C29	0.87	11.40	0.99	282	82.9	1.280	103.0	63.5	0.18	216.0
I-C30	0.28	7.94	0.25	285	46.3	0.264	80.4	25.7	0.08U	107.1
COMP IV	0.28	8.50	0.32	414	44.2	0.272	87.0	28.6	0.09	113.2
I-C 9	0.50	10.60	0.59	301	68.9	0.502	108.4	52.9	0.18	166.4
I-C10	0.14	3.35	0.16	441	24.3	0.107	72.0	16.5	0.08U	67.4
I-C11	0.12	4.30	0.15	955	24.8	0.101	74.9	13.3	0.08U	79.6
I-C12	0.50	11.50	0.52	240	74.4	0.518	113.8	51.9	0.22	176.4
I-C31	0.15	6.99	0.59	345	32.5	0.177	77.6	20.4	0.22	91.6
I-C32	0.50	11.10	0.42	198	75.1	0.500	110.4	50.7	0.18	192.0
I-C33	0.20	5.23	0.21	525	39.8	0.207	78.9	21.9	0.08U	96.7
I-C34	0.42	9.50	0.38	275	69.2	0.426	101.6	45.3	0.18	159.1
COMP V Rep 1	0.14	5.41	0.19	498	25.1	0.147	69.6	17.0	0.09	66.5
COMP V Rep 2	0.09	4.57	0.18	606	25.2	0.151	68.4	17.7	0.09	65.9
COMP V Rep 3	0.10	NT	0.16	NT	NT	0.147	NT	NT	0.09	NT
I-C13	0.15	6.15	0.21	643	30.4	0.184	82.0	20.6	0.08U	86.2
I-C14	0.24	8.90	0.26	405	38.1	0.236	84.3	26.7	0.08U	104.3
I-C15	0.09	6.65	0.15	454	20.6	0.120	66.5	12.2	0.08U	58.8
I-C18	0.33	4.10	0.52	327	43.6	0.685	73.5	43.3	0.09	117.9
COMP VI	0.19	9.10	0.30	303	35.7	0.210	79.8	20.2	0.09	88.4
I-C16	0.17	5.24	0.24	640	29.1	0.178	75.8	23.5	0.08U	91.9
I-C17	0.68	10.10	0.84	258	82.2	0.798	110.1	79.3	0.23	200.0
I-C35	0.35	8.20	0.19	297	59.7	0.582	93.8	49.5	0.18	143.4
R-AM	0.02	13.20	0.35	121	11.4	0.048	38.8	11.0	0.08U	35.4

NT = Triplicate not analzed by x-ray fluorescence.

U = Undetected above the concentration given.

4.2.3 Biological Environment. Although many fish and wildlife resources commonly found in the subtidal sections of the Bay are also found in the Oakland Inner Harbor, past channel dredging projects, maintenance dredging, and other human activities have reduced the fish and wildlife habitat values of the Inner Harbor channel and adjacent areas (FWS 1992). An example is benthic organisms in the existing channels are presently removed and disturbed by maintenance dredging and the prop wash of deep-draft vessels. As a consequence, benthic communities may not attain the same species diversity and abundance as in undisturbed subtidal areas of the Bay (FWS 1992).

4.2.3.1 Benthos. Benthic marine organisms occur in channel bottoms and adjacent areas and include worms, crustaceans, and shellfish. Benthic invertebrates are an important part of the aquatic food web. These organisms are primary or secondary consumers and are often prey for fish at higher trophic levels. The abundance and diversity of benthic organisms are affected, in part, by annual maintenance dredging and shoaling of the channel bottom. Organisms must be able to adapt to the disturbed environment. The polychaete worms, such as Streblospio benedicti, and mollusks, such as Gemma gemma, typically inhabit disturbed estuarine environments (Nichols 1979).

4.2.3.2 A survey performed in the early 1970's, by the Stanford Research Institute, identified 137 taxa at a sampling site in the Oakland Inner Harbor. The dominant species found were the polychaete worm and molluscs (Exogone lourei and G. gemma), including the bentnose clam (Macoma nasuta, Macoma inquinata, Mysella sp., and Musculista senhousia). A 1976 survey, performed by Madrone Associates for the Port of Oakland's Market Street Terminal, found that the dominant benthic species were the polychaete worms (Cirriformia spirabrancha and Cirratulus cirratus (now named Cirriformia luxuriosa)) and the bentnose clam (COE 1984). Studies conducted near the mouth of the Oakland Outer and Inner Harbors have confirmed the occurrence of common marine invertebrates including polychaete worms, amphipods (Corophium sp.), mussels (Mytilus edulis), the bivalve (G. gemma), and bentnose clam (Navy 1990).

4.2.3.3 Fish. Many species of fish are found in the Oakland Harbor and they are representative of those species typically found in the Central Bay. Due to the varying salinity regimes characteristic of the estuary, San Francisco Bay sustains a wide variety of fishes, both estuarine and marine varieties. Included in this assemblage are surfperch, shiner perch, pile perch, flounder and staghorn sculpin. Anadromous game fish (species having a life cycle that requires both fresh and saltwater conditions) such as striped bass and American shad are occasionally taken in the estuary (COE 1984). Generally,

however, the Oakland Harbor area is located away from the main migration routes of anadromous fish.

4.2.3.4 Bait and forage fish include, anchovies, herring, and smelt. Bottom fish include sharks, rays, and croakers. Fish taken in CDFG seines in the area included topsmelt, jacksmelt, northern anchovy, arrow goby, staghorn sculpin, and shiner perch. A number of flatfish species, including English sole, starry flounder, California halibut, and diamond turbot also occur in the area. These species are typical of flat, sandy-silty areas interspersed with vegetation.

4.2.3.5 Wildlife. Some small mammals (Mus and Rattus spp.) may be present in the developed areas adjacent to the Inner Harbor channel, however, few, if any, native terrestrial mammals would be affected by the limited 38-foot project. Marine mammals, such as the California sea lion (Zalophus californianus) and harbor seal (Phoca vitulina) occasionally use the Inner Harbor channel. The nearest known harbor seal haulout is on Yerba Buena Island, several miles distant from the Oakland Inner Harbor channel (FWS 1992).

4.2.3.6 Waterbirds found in adjacent Bay waters also use the Oakland Inner Harbor. Shorebirds, diving ducks, grebes, gulls, and cormorants are often found in an area of algal growth along the channel's southern reach during low tide (COE 1984). Diving ducks may feed elsewhere in the Inner Harbor channel and, like other waterbirds, use the Harbor waters for resting. Several species of gulls, grebes, and terns are present in the Harbor year-round, while others are seasonal visitors. Migratory waterfowl use the area during the fall and winter for foraging and resting.

4.2.3.7 Threatened and Endangered Species. The California least tern (Sterna antillarum browni) is a Federally listed endangered species known to nest on artificially created, sandy upland sites at Oakland International Airport and the runway apron at the Alameda Naval Air Station (COE 1988 and FWS 1992) adjacent to Oakland Harbor. During the nesting season (April through August), this species can be found foraging in Bay waters within and adjacent to the Oakland Inner Harbor Channel (COE 1988 and FWS 1992).

4.2.3.8 The Federally listed threatened California brown pelican (Pelecanus occidentalis obsoletus) disperses to west coast estuaries, including San Francisco Bay, between early summer and midwinter. The largest brown pelican roost within the Bay is located on the breakwaters to the south of Alameda Naval Air Station, and they are known to forage along the Oakland Inner Harbor channel.

4.2.3.9 The Federally listed endangered American peregrine falcon (Falco peregrinus anatum) is most common to the San

Francisco Bay area during the winter, when migrants from further north concentrate in the estuary. Their nesting season is from spring through early summer, and peregrine falcons have begun nesting in the Central Bay - several pairs nest on the Bay bridge (FWS 1992). Being opportunistic predators, peregrine falcons may take waterbirds and shorebirds (as well as pigeons) several miles from their nests.

4.2.4 Socioeconomic Environment.

4.2.4.1 The Port of Oakland is located in the fourth largest metropolitan area (CMSA) in the United States. This area contains a population of 6,104,000 (1990 census), and ranks fourth in the nation in purchasing power. In addition, the Port's Marine Terminal Facilities rank as the fifth largest container port in the nation. The contribution of the Port's maritime operations to the local, regional, state, and national economies are directly realized in terms of:jobs; personal income; business revenue; and local, county and state taxes (Port 1992).

4.2.4.2 Over 188,000 jobs are related in some way to the movement of cargo across the Oakland marine terminal facilities, which are adjacent to the entire Oakland Harbor. When considering the personal income related to directly dependent and induced jobs, as well as, a re-spending effect, the result is over $430,000,000 in personal income and consumption expenditures for California residents (Port 1992).

4.2.4.3 The Port of Oakland currently (1991) generates over $729,000,000 in direct operating revenue for businesses providing maritime services for vessels and cargo. In addition, $38,300,000 in state and local taxes are generated through Port business activity (Port 1992).

4.2.4.4 The Oakland Inner Harbor is 8.54 miles long, with a total terminal area of 150 acres. Two container terminals, APL Terminal and Howard Terminal, are served by the Inner Harbor channel. Together, these terminals comprise 124 acres, or 33%, of the Port's 373 acres of marine container terminal capacity. Facilities located at these terminals include 6 of the Port's 18 primary containership berths and 9 container gantry cranes, 3 of which are post-Panamax size new generation cranes.

4.2.4.5 Maritime operations at these two terminals during the last several years has accounted for 32% (on average) of all container cargo handled at the Port. In relation to the Port's total maritime operations, approximately one-fifth, or 1,400 direct jobs, are generated by activity at these two terminals. Maritime activities at the two terminals generate 2,000 direct and induced jobs with an associated

personal income of over $89,000,000 (includes re-spending affect). More than $8,000,000 in state and local taxes are generated through the APL and Howard terminals. Over $175,000,000 in business revenue is generated. This figure accounts for almost one-fourth of the business revenue currently generated by the Port's total maritime operations. (Port 1992).

4.3 Alcatraz Dredged Material Disposal Site.

4.3.1 The San Francisco Bay estuary has an area of 396 square miles at MLLW and 460 square miles at mean higher high water (MHHW). Extensive intertidal mudflats, encompass an area of 64 square miles at lower low water. The Bay is generally shallow, with two-thirds of the area less than 8 feet deep, and only 20% of the Bay is greater than 29 feet deep. Most of the fresh water inflow to the Bay is runoff from the central Valley drainage basin, which covers 40% (63,000 square miles) of California's land area. The runoff from this basin provides 90% of the fresh water inflow to the Bay, with 80% of this flow contributed by the Sacramento River and its tributaries to the north. Fifteen percent of the fresh water inflow to the Bay originates from the San Joaquin River system to the south, and 5% from the east-side streams.

4.3.2 The Alcatraz site has been used since the late 1800s for disposal of dredged material. Since being designated as suitable for dredged material disposal in 1972, Alcatraz has been the most widely used dredged material disposal site in the Bay. Alcatraz was originally selected for use as a disposal site because of the swift tidal currents that occur in the area. The currents were predicted to disperse disposed sediments over a large area of the Bay and to the ocean.

4.3.3 Sediment Quality.

4.3.3.1 In September 1990, sediment samples were collected from eight locations 0.2 to 0.5 miles from the periphery of the Alcatraz disposal site. The sediment samples from this area, described as the Alcatraz Island Environs, were composited, and labeled R-AM, to obtain a representative reference site sample for comparison against sediment samples from the proposed limited 38-foot Oakland Inner Harbor channel. The joint EPA/Corps February, 1991 "Evaluation of Dredged Material Proposed For Ocean Disposal - Testing Manual" (otherwise known as the "Green Book", which is available in the Corps of Engineers, San Francisco District office, 211 Main St., San Francisco, CA 94105-1905) recommends that the reference sediment be collected from within the dredged material disposal site proper, in this case the Alcatraz disposal site. (Note: the "Green Book" testing requirements are more stringent than the current

Section 404 testing requirements.) However, rather than using sediment samples from the Alcatraz site proper as a test reference, the Corps (with the concurrence of other Federal and State regulatory and resource agencies) used the "cleaner" Alcatraz Environs sediments to compare against the Oakland Inner Harbor sediments. Use of the Alcatraz Island Environs sediment samples as the test reference is a more environmentally conservative approach to evaluate the suitability of the Oakland Inner Harbor limited 38-foot project dredged material for unconfined aquatic disposal at the Alcatraz site.

4.3.3.2 Physical and chemical analyses of the R-AM sediment composite sample consisted of grain size, TOC, TVS, oil and grease, and TPH (reference Table 1), PAHs and butyltins (reference Table 2), chlorinated pesticides, PCBs, and metals (reference Table 3). The R-AM reference sediment is composed of 98% coarse-grained material (94% sand, 4% gravel, 1% silt, and 1% clay). No PCBs were detected (detection limit of 24 ppb) and no chlorinated pesticide compounds were detected, at detection limits which varied from 2.4 ppb to 24.0 ppb.

4.3.4 <u>Sediment Transport; Turbidity and Suspended Sediment; and Water Quality</u>.

4.3.4.1 <u>Sediment Transport</u>. Hydraulic circulation at the Alcatraz disposal site is dominated by local semidiurnal tides, with generally minor seasonal related wind and river inflow influences. Infrequent river inflow events can upset normal current directions and velocities over several tidal cycles (COE 1988). Measurements of tidally dominated, oscillatory currents at the Alcatraz site, prior to 1985, indicated maximum current speeds may reach 2.9 knots, with east and west principal flow directions (Dames and Moore 1971; Rubin and McCulloch 1979; Goddard et al. 1984).

4.3.4.2 Mixing and circulation of Bay water affects the transport of sediments, nutrients, and other organic and inorganic substances brought into the estuary by both tides and freshwater runoff. Tidal currents and wind-wave effects tend to keep material suspended throughout the water column, but it eventually settles out, either in the ocean or in the shallows of the Bay. Sedimentation normally occurs when low salinity content water meets high salinity content water - the sediments differentially settle in the intertidal flats and channels. The fine material, that settles on the intertidal flats, is often resuspended and redistributed by wind-generated currents and waves, whereas those coarser sediments, which settle in the Bay channels, are more or less permanent and often compacted to several feet deep.

4.3.4.3 The major transportation mechanism of the dredged sediments, in the natural channels, is by tidal currents and

occurs at depths greater than the depth of effective wave action. Dredged sediments have a tendency to remain within the confines of the natural channels for at least a short period of time. The natural channel network in the Bay leading to the ocean is not continuous, causing the dredged sediments, like natural sediments, to leave the boundaries of the natural channels and move onto the shallows and eventually become part of the resuspension - circulation - redeposition cycle.

4.3.4.4 At the Alcatraz disposal site, following the initial deposition of dredged sediments, a portion of the discharged material is again resuspended and carried from the site by tidal currents. Dredged material retained at the Alcatraz site, based upon monthly bathymetric surveys and logs of disposed sediment quantities, is calculated to be 20% within 1,000 feet of the site center and 30% within a 2,000-foot radius of the site center. An additional 5% to 10% is estimated to have been deposited in the bathymetric depression on the east and south perimeter of the site. This material accumulated via gravity induced flow of the fluid mud fraction of material deposited during the passive transport phase.

4.3.4.5 Based upon a study of Alcatraz disposal site erodability conducted in 1987, after initial deposition, slightly more than half (52.5%) of the total dredged material discharged at the Alcatraz site is resuspended and transported by strong currents from the vicinity of the site. The erosional capacity of the site for the high water content, fluid material (1.3 g/cc or less) is much higher than the amount of material deposited (Teeter, 1987). Combining this with the 10% lost to the water column during the convective descent phase, means approximately 5/8 (62.5%) of the material discharged at the Alcatraz site is dispersed and transported from the site.

4.3.4.6 The dominant direction of sediment transport, whether suspended or surficial load, under normal tidal circulation is in an east-west alignment in the Central Bay. Under extreme events, such as high freshet conditions or coastal storm episodes, tidal circulation patterns may not dominate in determining predominate accretion and erosion patterns. However, during normal periods, sediment transport in the northern part of the Central Bay appears to be oriented to the east, and transport in the southern part is oriented towards the west. Thus, with respect to dredged material discharge at Alcatraz, the 10% of the material suspended in the water column is estimated to be about equally divided between being carried out of Golden Gate and farther into the Bay. The portion of suspended sediment moving into the Bay probably settles in an accretion zone near channel margins and quiet shallow areas of the Bay. The material that is subsequently eroded from the settled

deposit at the Alcatraz site probably moves toward the Gate, with a portion shunted back into the Bay as it approaches the Gate. The San Francisco Bay-Delta hydraulic model studies indicate that about 47% of the material discharged at Alcatraz can be expected to move out of the Gate and about 53% remains in the Bay.

4.3.4.7 In summary, the percentage of discharged dredged material that is retained in the Central Bay is approximately 50% -- 37.5% retained at the Alcatraz site and 12.8% (7.8% from the bed and 5% in the water column) being widely distributed over the Bay. The upper South Bay (the area encompassing the Port of Oakland, Alameda and south to the San Mateo Bridge) receives approximately 6.1% of the transient deposit and possibly some small percentage (less than 1%) of the material suspended in the water column. The amount of material that is estimated to drift to the ocean is approximately 30% (24.7% from the transient deposit and 5% in the water column) (COE 1988).

4.3.4.8 The Alcatraz site was originally selected because of the expectation that tidal currents would disperse discharged dredged sediment. An investigation by Winzler and Kelly (1985) indicated that the magnitude of the Alcatraz site currents is strongly correlated with tidal range. The maximum near surface velocity was measured at 2.76 knots, the maximum mid-depth velocity was 2.86 knots and the highest near-bottom velocity was 2.12 knots. In the last several years, depositional mounding at the Alcatraz site has become an issue, in terms of site capacity and as a potential hazard to deep-draft navigation. As of November, 1991, bathymetric survey data indicated that about 3,000,000 cys of dredged material site capacity remain, before mounding would affect deep-draft navigation. In response to the need to manage disposal site capacity, the RWQCB, in Resolution No. 90-37, and the Corps of Engineers have adopted seasonal limits on the quantity of material to be disposed at Alcatraz. Use of the Alcatraz disposal site is restricted by the target volumes listed below.

Period	Volume (cys)
Annual	4,000,000
Monthly (Oct-Apr)	1,000,000
Monthly (May-Sep)	300,000

4.3.4.9 Turbidity and Suspended Sediment. Turbidity in San Francisco Bay and the level of suspended sediment within the Bay are not synonymous. High levels of solute organic acids and other substances that can inhibit light transmission are found in the Bay water. Sources of particulate matter are: rivers; the ocean; sewage effluent; the atmosphere; resuspended substrate material; and biological processes. The total quantity of material in solution and the amount of

particulate matter in suspension, at any given time, is highly variable, and is greatly influenced by the dynamics of San Francisco Bay. Since many factors can affect turbidity, measurements of turbidity in San Francisco Bay do not accurately define the level of suspended sediment present in Bay waters.

4.3.4.10 Suspended sediments contribute to the suspended particulate loading of San Francisco Bay, and the suspended particulates augment Bay water turbidity. The estimated suspended particulate loading to Bay waters due to disposal of dredged material at Alcatraz is a distant third (and small in comparison) to Bay suspended particulates contributed by (1) the natural resuspension of sediments by wind generated waves and (2) riverine sediment inflow. The estimated annual suspended particulate loading in Bay waters contributed by the above named sources (volumes calculated with specific gravity value of 2.65 and saturated density of 1.3 g/cc) are: (1) wind/wave resuspension = 170,000,000 cys; (2) riverine inflow = 10,500,000 cys (COE 1988); and (3) dispersion of dredged material disposed at the Alcatraz site = 1,250,000 cys (based on the 1991 disposal of 2,000,000 cys at Alcatraz). Based upon these figures, the proposed project would only amount to approximately 0.2% of the total annual sediment load of the Bay.

4.3.4.11 Tidal and wind-induced currents, together with the Delta inflow, are one of the primary reasons why San Francisco Bay is naturally turbid year-round, with visibility confined to only about a foot or less. The turbidity attributable to the additional sediments resuspended by dredged material disposal at Alcatraz is minor. The influence of tidal circulation in the Bay, which transports sediment laden waters from the shallow areas of the Bay and Delta and the relatively clear waters from the ocean (back and forth across the disposal site), is overwhelmingly the most important factor affecting suspended sediment load.

4.3.4.12 It has been alleged that in-Bay aquatic dredged material disposal activity significantly contributes to Bay turbidity levels and that high turbidity levels adversely affect selected Bay fisheries (COE 1988). Corps studies (AHI 1991) showed there is no correlation between the level of dredged material disposal at the Alcatraz site and turbidity in the Central Bay (based upon a 1980-1987 period of Secchi disc data from 3 Central Bay stations). In fact, the May-October period, which reflected the highest level of turbidity, coincided with the lowest level of dredged material disposal activity of several years. The recorded highest annual turbidity occurred in 1983, when dredging activity during that year was below the seven year average. Dredged material disposal in 1987 was the highest of several years, yet turbidity levels measured by Secchi disc were

third highest of the seven year period, and below turbidity levels in 1983 and 1986. In summary, turbidity and suspended solids monitoring at the Alcatraz site during dredged material disposal has shown that turbidity levels at the site are influenced more by tidal oscillation of waters of varying sediment load from beyond the site than by dredged material disposal.

4.3.4.13 Secondly, the correlation between the Secchi disc turbidity data and sport fishing catch reports are tenuous at best (AHI 1991) (based upon a 1980-1987 period of Secchi disc data from 3 Central Bay stations, which was collected by the CDFG and compared to "partyboat" fish catch log data for the same time period). Sport fishing log reports indicated above-average fishing in 1983, when the highest levels of turbidity were recorded by the Secchi disc data. Log reports showed the worst sport fishing occurred in 1987, however, turbidity levels were only the third highest of the seven year period. Further, fishing success was better in 1986 than in 1987, but turbidity was higher in 1986 than in 1987.

4.3.4.14 Studies (AHI 1991) have demonstrated that aquatic dredged material disposal activities do increase suspended sediments and turbidity in the immediate vicinity of the Alcatraz site for a short duration. However, the studies have also demonstrated that the oscillation of the sediment laden waters between the shallow areas of the Bay and the relatively suspended sediment free waters near the ocean is the major contributor to turbidity and suspended sediment levels at the Alcatraz disposal site and within the Bay.

4.3.4.15 <u>Water Quality</u>. Water quality at the Alcatraz dredged material disposal site, and San Francisco Bay in general, is dominated by the tidal influx of ocean water, and to a lesser extent affected by riverine inputs, local surface runoff, effluent discharges, and maritime use.

4.3.4.16 Within the Central Bay, salinity is generally lowest in the rainy season and highest in the late summer months. Values range from 18.0 to 30.5 parts per thousand (ppt) with an average of 24.5 ppt (COE 1976). Salinities measured at the Alcatraz disposal site in October 1984 ranged from 30.45 ppt to 30.68 ppt, at depths of 4.3 feet and 89.6 feet, respectively (Goddard et al. 1984). Salinities measured in July 1985 at the disposal site ranged from 31.9 to 34.6 ppt.

4.3.4.17 Dissolved oxygen levels within the Central Bay water are generally high, with concentrations ranging from 6.6 to 9.0 mg/l, and averaging 7.9 mg/l. pH values exhibit little variation due to the high buffering capacity of the Central Bay waters and sediments, with pH levels ranging from 7.3 to 8.0 (COE 1976). Surveys in October 1984 by

Goddard et al. (1984), found a constant pH of 7.8 at all water depths at the Alcatraz site.

4.3.5 Biological Environment.

4.3.5.1 Benthos. A moderately high number of benthic organisms were sampled at the Alcatraz dredged material disposal site during October, 1984 and February, 1985. A wide variance was noted when the taxonomic groups decreased by about one-half between the two sampling periods. The abundance diminished by 99%. The five dominant groups, by density, sampled during the 1984 survey included the amphipods (Ampelisca abdita and Photis brevipes), nematodes (unidentified), Tellina clam (Tellina nuculoides), and the polychaete worm (Glycera capitata). The amphipod, A. abdita was found in relatively high numbers (mean number/square meter was over 10,000). The five dominant groups, by density, at the Alcatraz site, identified during the 1985 survey, included Tellina clam (T. nuculoides) and four polychaete worms (Armandia brevis, Glycinde polygnatha, Polydora brachycephala, and Heteromastus filiformis); all found in relative low numbers (mean number/square meter from 8 to 25).

4.3.5.2 Fish. There are numerous important commercial and recreational fish species in San Francisco Bay. Mid-water level reconnaissance surveys of the Alcatraz disposal site were conducted in October 1984 and February 1985 (Kinnetics, 1985). Otter trawl sampling in 1984 revealed the presence of shiner perch (Cymatogaster aggregata), longfin smelt (Spirinchus thaleichthys), brown rockfish (Sebastes auriculatus), plainfin midshipman (Porichthys notatus), market crab (Cancer magister), and crangon shrimp (Crangon nigricauda). The 1985 survey yielded herring (Clupea pallasii), northern anchovy (Engraulis mordax), white croaker (Genyonemus lineatus), northern anchovy (Engraulis), longfin smelt (S. thaleichthys), crangon shrimp (C. nigricauda and franciscorum), and big skate (Raja binoculata). Mid-water trawls during February revealed a paucity of finfish at the Alcatraz site.

4.3.5.3 Some of the more important fisheries known to exist in the vicinity of the Alcatraz disposal site are discussed below:

(1) Northern Anchovy. The northern anchovy is typically abundant in the Bay during the April through October time period. Their presence at the Alcatraz site is incidental and, when present, serves to attract predators, such as the striped bass.

(2) Herring (Clupea pallasi). The herring spawning season is especially important in the Bay, due to the significant commercial harvesting of the roe. Spawning typically occurs

between November through May, in 15 feet of water, usually at night during the high tide. Spawning is also influenced by salinity with optimum conditions in the range of 13 to 19 ppt. Herring harvesting occurs along the eastern San Francisco, Oakland, and Richmond waterfronts and other shallow areas along the shoreline. No herring spawning is known to occur at the Alcatraz disposal site. Herring migration accounts for their presence in the vicinity of the Alcatraz site.

(3) English sole (Pleuronectes vetulus). This bottom fish has a preference for intertidal, shallow, relatively quiet waters with fine sandy sediments. This species appears to be influenced by Delta outflows as young fish generally appear to be more abundant in the Bay during high Delta outflow (COE 1988). Their presence at the Alcatraz disposal site is transient.

(4) California Halibut (Paralichthys californicus). Halibut is a coastal species, which typically spawns at depths between 18 and 60 feet during the period between February and July. Little is known about its life history in San Francisco Bay. Large, mature individuals are fished in the Central Bay and in San Pablo Bay. Smaller and younger individuals are commonly collected in otter trawl surveys in the Bay, but do not account for a large numerical proportion of the survey.

(5) Salmon (Oncorhynchus sp.). Salmon are anadromous fishes; they migrate to, and spawn in, upstream rivers, and their young migrate to the ocean for adult life. Annually, there are four runs of salmon through San Francisco Bay. The migration population varies through the year and their presence at the Alcatraz site is transient.

(6) Striped Bass (Morone saxatilis). Striped bass are an eastern species introduced to San Francisco Bay in 1879 (COE 1988). They are an anadromous fish that has become a popular Bay sport fish. Striped bass have been studied intensively as a result of declines in catch. Spawning occurs above the confluence of the Sacramento-San Joaquin Rivers during spring. Young striped bass nursery in a nutrient rich area in the vicinity of Alcatraz Island between June and November, as their migration to the upper estuary begins. They tend to aggregate in areas of abrupt depth changes and high current velocities (e.g., the South Tower of the Golden Gate Bridge, the area northwest of Alcatraz Island, and Raccoon Shoal (COE 1988).

4.3.5.3 Marine Mammals. Marine mammals occurring in the vicinity of the Alcatraz disposal site include the California sea lion, the harbor seal, and harbor porpoise (Phocoena phocoena).

4.3.5.4 Threatened and Endangered Species. The Federally listed threatened California brown pelican and endangered American peregrine falcon may occasionally be found in the vicinity of the Alcatraz disposal site reference EA paragraph 4.2.2.d.)

4.3.5.5 The Federally listed threatened (State listed as endangered) winter-run chinook salmon (Oncorhynchus tshawytscha) pass through San Francisco Bay as adults, on their way upstream to spawn, from November through May, and as juveniles, on their way to the ocean, from November to late May. Four races of the chinook salmon (fall, late fall, winter and spring runs) spawn in the upper Sacramento River basin. The winter run, once the second largest run, is now the smallest run.

4.3.5.6 Winter-run chinook spawning and incubation take place upstream of the Delta, and some juveniles and fry rear in the Delta. Juvenile chinook are drift feeders, consuming aquatic and terrestrial insects, crustaceans, chironomid larvae, and caddis flies, while they are in fresh water. Their diet changes to mainly Neomysis sp., Crangon sp., and Gammarus sp. as they move into more saline waters (Wang 1986; SWRCB 1990). Some chinook do not start their downstream migration until they reach their early smolting stage. Smolt emigration through the Delta usually peaks in May, however, there are year-to-year variations in the timing of emigration. Adult upstream migrants have been caught in Suisun Bay, near Montezuma Slough, and in the vicinity of the Pittsburg and Contra Costa power plants in October (Wang, 1986).

4.3.6 Socioeconomic Environment.

4.3.6.1 Navigation. The San Francisco Bay Region has six public ports (Ports of Benicia, Oakland, Redwood City, Richmond, San Francisco, and Encinal Terminals), eleven navigable waterways, several military terminals, and a variety of proprietary maritime terminal facilities. The ports within San Francisco Bay play an important role in the nation's waterborne commerce.

4.3.6.2 Records of the San Francisco Vessel Traffic Service (VTS) up through 1987 indicate that total marine traffic in San Francisco Bay in 1982 was about 66,000 vessel movements (VTS, unpubl. data, 1987). Vessel movements increased by about 25% to approximately 82,000 in 1986. Most of this increased vessel activity was due to increased dredging vessel movements and operation of a ferry service between Vallejo and San Francisco. In 1986, ferry vessel traffic represented 50% of all vessel movement in the Bay, while cargo vessels, tankers, and tugs (which include towed dredge barges) represented about 36% of the vessel movements (VTS, unpubl. data, 1987). Self-propelled dredge vessel activity

represented about 9% of 1986 vessel movements.

4.3.6.3 VTS dredged material disposal activity records indicate that the Alcatraz site receives the majority of the disposed dredged material in the Bay. During the period between April 1986 and March 1987, a total of 2,535 dredge barge trips for disposal at Alcatraz were recorded - 1,032 were self-propelled vessels (hopper dredges) and 1,503 were non-self propelled (tug/barge) vessels. Based on this data, there was an average of seven dredge vessel trips per day for the twelve month period, with a high average of 20 trips per day in March, and a low average of 1.5 trips per day in August.

4.3.6.4 Commercial and Sport Fishing. Herring are the primary commercial fish species in the Central Bay. Other species of historic commercial importance include shark, perch, Jack smelt, shrimp, and crab.

4.3.6.5 Striped bass have been the primary sport fishing species in the Central Bay. Other sport fishing species include sturgeon, perch, flounder, shark, rockfish, and halibut.

4.3.6.6 Although commercial and sport fishing remains a multi-million dollar industry in the Bay Area, some fishing interests believe there has been a decline in fish harvests and revenues (COE 1988). Examination of causes in the fishery decline have been undergoing scientific scrutiny for several years. The following combination of major factors have been closely associated with the decline in the Bay fisheries: (1) large water diversions in the Sacramento River and San Joaquin River Delta area; (2) loss of upstream riverine spawning habitat; (3) meteorological changes; (4) exploitation of the fishery resource; (5) substantial predation; and (6) environmental contamination.

4.4 Port Sonoma - Marin and Redwood Landfill Sites.

4.4.1 Port Sonoma - Marin is located at the mouth of the Petaluma River, in Sonoma County. It is a 110-acre site comprised of a recreational marina and support facilities, including 16-acres of dredged material drying ponds. The drying ponds have total capacity of 150,000 cys per year.

4.4.2 Redwood Landfill is located along the western margin of the central Petaluma Valley, specifically between the Northwestern Pacific Railroad tracks and San Antonio Creek, approximately 4 miles north of the City of Novato, Marin County, California and approximately 7 miles southeast of the City of Petaluma, Sonoma County, California (EMCON 1989).

4.4.3 The landfill facility is a 600 acre Class II-2 sanitary landfill. The site is a combination trench and area fill operation. Existing elevations at the site range from 0 to -2 feet mean sea level (MSL) in the north and east areas to nearly 40 MSL within the active solid waste disposal area. Most of the site is surrounded by a perimeter levee with a crest elevation ranging from 6 to 9 feet MSL (EMCON 1989).

4.4.4 The site contains and is surrounded by natural and man-made sloughs, including San Antonio Creek. The man-made slough west of the site intercepts streams and surface runoff from the bordering highlands. The ponds and ditches within the site are not connected directly to the surrounding sloughs because the site has constructed perimeter levees EMCON 1989).

4.4.5 Redwood Landfill operates under the following permits: Marin County land use; Marin County Health Department; Marin County Waste Facilities Permit; Marin County Environmental Health Services; RWQCB, San Francisco Bay Region; and Bay Area Air Quality Management District. The site is approved to receive "dredge and fill materials". Because of the Port of Oakland's non-Federal responsibility for upland disposal sites, the Port has initiated, and continues, coordination with Redwood Landfill on acceptance of the Oakland Inner Harbor channel sediments at the site. The Port provided the RWQCB with the chemical analysis of the sediment samples and by letter dated February 26, 1992, Redwood Landfill has requested the RWQCB to approve use of the Oakland Inner Harbor dredged material for daily landfill cover.

5.0 ENVIRONMENTAL CONSEQUENCES.

5.1 Oakland Inner Harbor.

5.1.1 Turbidity; Sediment Transport; and Bathymetric Changes.

5.1.1.1 Dredging operations, whether by self-propelled hopper dredge or by clamshell dredge, would result in temporary, and insignificant, increased turbidity, or sediment load, of nearby waters at the dredging site. The hopper dredge disrupts channel bottom sediments as the trailing dragheads pass through the dredging area. There is a continuous resuspension of bottom sediments with the hopper dredge during the period the dragarms are in contact with the sediment face. With a clamshell dredge, the bucket loses some sediments as it is raised through the water column and dumped into a barge. Insignificant, temporary increases in surface turbidity also occur as supernatant water in the hopper or barge are allowed to overflow, in

order to achieve an economical load.

5.1.1.2 Dredging of the limited 38-foot channel is not expected to affect transport of sediment material. Potential temporary, slight increases in sediment loading of adjacent berths and marinas in the channel may occur as sediment is dredged from the bottom.

5.1.1.3 Shoaling rates in the Inner Harbor existing maintenance dredged channel vary year to year, due to variable sediment inflow volume, wind-wave action, and current velocities. Annual maintenance dredging of the existing Inner Harbor channel has averaged 143,000 cys over the last 15 years, with a high of 480,000 cys and a low of 46,000 cys. Limited deepening of the Inner Harbor channel to -38 feet MLLW would result in a negligible (estimated at ± 7,000 cys) increase to the existing annual maintenance dredging quantities. The deeper channel would not change the volume of the tidal prism or current patterns.

5.1.2 Sediment and Water Quality.

5.1.2.1 Water quality parameters are directly related to the interaction of sediment disturbances and water column effects at the dredge site. Of interest are the following water quality parameters: salinity, temperature, dissolved oxygen concentrations, pH, suspended solids; heavy metals, petroleum hydrocarbons, organic carbon, PAH, pesticides, PCB, and butyltin compounds. Since most of the effects of dredging on water quality are short term and have been identified in previous studies, the Oakland Inner Harbor salinity, temperature, dissolved oxygen concentrations, pH, and suspended solids levels are expected to have little or no change as a result of deepening the channel to -38 feet MLLW.

5.1.2.2 The potential for release of contaminants into the water column during the dredging activity was assessed in both the March, 1988 Final Supplement Number 1 To The Environmental Impact Statement (SEIS), Oakland Outer and Oakland Inner Harbors Deep-Draft Navigation Improvements, Alameda County, California and the November, 1984 Oakland Inner Harbor, Alameda County, California, Deep-Draft Navigation Improvements Final Feasibility Study and Environmental Impact Statement. Based upon the sediment testing conducted for these studies, the documents concluded there would be no unacceptable adverse impact to the water column as result of sediment contaminant release.

5.1.2.3 Based upon sediment resampling and testing conducted under the 1991 "Green Book" manual as stated in EA paragraph 1.4 - Project Description, sediment from the Oakland Inner Harbor limited 38-foot project has been separated into two categories; those sediments that have

been determined suitable for unconfined aquatic disposal at Alcatraz and those sediments that are unsuitable for unconfined aquatic disposal. The proposed project design, in part, was determined by the presence and proximity, within the Inner Harbor channel, of sediments unsuitable for unconfined aquatic disposal at Alcatraz. Composite area VI will not be dredged, since the area is outside of the limited 38-foot project boundary. A portion of Composite area III (the Alameda shore side of the channel containing sediment sample stations I-C29 and I-C30), determined to be unsuitable for unconfined aquatic disposal, will be avoided via channel realignment. Portions of Composite areas IV and V, on the Alameda side, which are outside of the limited 38-foot project boundary will not be dredged. The material to be dredged from portions of Composite areas IV and V, which is unsuitable for unconfined aquatic disposal, will be disposed at the Redwood Landfill, after drying at Port Sonoma - Marin.

5.1.2.4 Potential project impacts of unsuitable (for unconfined aquatic disposal) material exposed in the channel bed and/or side slopes <u>following</u> dredging are addressed. Conceptually, chemical constituents of the unsuitable material could release into channel waters, either as unbound chemicals, or attached to particles loosened during the dredging process, or through subsequent maintenance dredging, or by passing ships. Since the chemical constituents associated with dredged sediments remain bound to the sediments during the high agitation that occurs during disposal activities, it is reasonable to presume that the chemical constituents contained in the sediments left exposed, following dredging, would also remain attached.

5.1.2.5 Based upon chemical and biological tests conducted on the limited 38-foot project sediment, it may be concluded that the sediment chemical constituents would most likely stay associated with those sediments after completion of the dredging (Battelle 1992a). Sediment, defined as the Older Bay Mud Unit (OBMU) and Merritt Sands, in the Inner Harbor channel is free of man-made contamination, and has no adverse biological effects. The sediments are extremely hard-packed and cohesive, have no measurable levels of man-made contaminants (e.g. pesticides, PCBs, organometals, or PAHs) and have lower concentrations of naturally occurring heavy metals than the Alcatraz reference area (except for Cr, Ni, and Se which are 2 to 3 times higher). The sensitive larvae life stage of the test organism Pacific oyster (<u>Crassostrea gigas</u>), exposed to suspensions of the OBM sediments demonstrated no significant acute toxicity. In addition, two species of invertebrates exposed to the OBM sediments over a 28-day period showed only a slight bioaccumulation of a few metals in their tissues. Removal of the less cohesive, softer, and more easily resuspended sediments (i.e. YBM), that overlie the Merritt Sands and

OBMU sediments, would expose sediment that essentially has no effect on the environment in terms of toxicity, bioaccumulation potential, and resuspension of bedded sediment material.

5.1.2.6 Those areas within the Oakland Inner Harbor channel that are likely to have the less cohesive, softer, and more easily resuspended sediments (YBM) remaining, after dredging to project depth, include Composite areas I and II (except sediment sample station I-C27) and the areas represented by sediment stations I-C9, I-C18 and I-C29. The depth of water required to reach the OBMU or Merritt Sands in the Inner Harbor limited 38-foot project channel ranges to -44 feet MLLW. The areas represented by Composite samples I and II (i.e. the entrance channel and outer portion of the Inner Harbor), which had no toxicity and only slight bioaccumulation of a few contaminants, are some of the stations that required deeper cores to reach the OBMU. Since the sediment showed no biological effects to project depth, it is logical to conclude that the more deeply buried sediment, which would be uncovered after dredging, would also not show biological effects. Other locations which required deeper penetration to reach the OBMU included sample stations IC-29 (Composite area III), and IC-9 (Composite area IV), and IC-18 (Composite area V). The IC-29 and IC-18 sediment sample areas will not be dredged, as they are outside the proposed limited 38-foot channel boundary; sample area IC-9 will be dredged by clamshell and disposed at the Redwood Landfill site. Since this material will be removed by clamshell, only a minimal amount of material would be resuspended into the water column. These small releases would be rapidly diluted by the surrounding waters. Any impacts to water quality from sediments entrained in the water column during clamshell dredging are expected to be temporary and minor. The sediment at the remaining stations within the proposed limited 38-foot Inner Harbor channel, when dredged to project depth, would result in exposure of the more compacted, uncontaminated, and biologically favorable sediment of the OBMU and Merritt Sands. Release of contaminants from, or resuspension of this sediment, would be unlikely.

5.1.2.7 The following is a discussion on the potential for chemical constituent release from sediments exposed along the channel side slopes <u>after</u> channel deepening. After dredging to -38 feet MLLW plus up to one foot of overdepth tolerance, some sediments unsuitable for unconfined aquatic disposal would be exposed along some channel side slopes. These sediments may remain exposed in portions of the channel side slopes in 3 areas: (1) in Composite area III, along side the sediment deposit represented by sediment sample stations I-C29 and I-C30 (the area which will be avoided due to channel realignment); (2) in Composite area IV, the Schnitzer Steel and former Todd Shipyard sides of

the of the future -42 foot MLLW deepening project turning basin; and (3) in Composite areas IV and V, the Alameda side and "up-channel" end of the -38 foot MLLW project bordering the sediments represented by sediment sample stations I-C33, I-C34, I-C12, I-C13, and I-C14 that will be disposed at the Redwood Landfill site. The chemical constituents associated with these remaining side slope sediments are most likely to remain bound to them, whether those sediments are dredged or not. Only YBM material exposed in channel side slopes may be of concern. Merritt Sands and OBM are, most importantly, suitable for unconfined for aquatic disposal, and are resistant to slumping and erosive forces because of their hard packed and/or cohesive properties. The only difference between the behavior of channel bottom and side slope sediments is the increased susceptibility of the latter to slumping and erosive processes. Potential stability problems can be overcome most readily and economically by designing the channel side slopes in accordance with the engineering properties of the YBM deposits. For this project, channel side slopes have been appropriately designed for 1 on 3 slopes. Consequently, sediments exposed along channel side slopes that are unsuitable for unconfined aquatic disposal should not contribute significantly to the dissolved or suspended sediment load of the channel's water column, or to the unsuitability for unconfined aquatic disposal of maintenance dredging sediments. The release, if any, of sediment associated chemical constituents, as a result of the exposure of side slope sediments, is not expected to occur. Any potential adverse effects to the water and sediment quality of the Oakland Inner Harbor channel, as a result of side slope exposure, would be minimal and temporary.

5.1.2.8 Based upon the sediment chemical and biological test results, no significant adverse impacts to the water column are expected to occur from chemical constituents associated with the Oakland Inner Harbor sediments (see EA paragraph 4.2.2 <u>Sediment Quality</u> for a physical and chemical description of the Oakland Inner Harbor sediments and EA paragraph 5.2.2.26 <u>Sediment and Water Quality</u> - for a summary of the toxicity and bioaccumulation analysis completed on the Oakland sediments).

5.1.2.9 The Merritt-Posey Aquifer is a shallow aquifer that underlies the Oakland and Alameda Island harbor areas. The potential for water quality impacts to the Merritt-Posey aquifer, due to deepening the Inner Harbor channel, has been fully addressed in the <u>Oakland Inner Harbor, Alameda County, California, Deep-Draft Navigation Improvements Final Feasibility Study and Environmental Impact Statement</u>, November,1984 and the <u>Final Supplement Number 1 To The Environmental Impact Statement (SEIS), Oakland Outer and Oakland Inner Harbors Deep-Draft Navigation Improvements, Alameda County, California</u>, March, 1988. The Corps' ongoing

quarterly groundwater monitoring program has shown that: increasing Bay water depth along the channel would not result in an increase in the salt water hydraulic head; salt water has already intruded into the Merritt-Posey Aquifer; and there would not be an increase in salinity intrusion with the deepening of the Inner Harbor channel. The proposed project would increase channel floor exposure by less than 25%, and would not induce further salt water intrusion. The potential for salt water intrusion already exists, and deepening the Inner Harbor to -38 feet MLLW would not increase that potential. The existing saltwater intrusion wedge would not be driven any further inland than would otherwise occur without harbor deepening. In summary, saltwater intrusion impacts from the proposed project are expected to be minimal.

5.1.3 Biological Environment.

5.1.3.1 Benthos. Benthic organisms in the Inner Harbor channel would be directly impacted by the proposed project. Since most of the limited 38-foot project area is within the existing 35-foot channel boundary, which is maintenance dredged annually, channel deepening impacts on benthos are expected to be temporary and minor. With annual maintenance dredging of existing channels, community stability of benthic life is limited. Resultant shoaling of excavated channel bottoms also contributes to the unstable community structure in the channel bottom. No extensive shellfish beds exist in the immediate vicinity of Oakland Inner Harbor. Most, if not all, benthic organisms in the Oakland Inner Harbor channel are expected recolonize and adapt to the periodic dredging disruption. Studies conducted throughout the Bay, specifically for dredging and disposal activities, have shown that recolonization occurs after dredging.

5.1.3.2 Fish. Initially, the channel benthic habitat at the dredging site would be disturbed, and food sources disrupted. There may be a temporary decrease in dissolved oxygen levels and an increase in available nutrients due to suspension of nutrient-rich sediments. These effects occur each year when the channel is maintenance dredged. Adult fish are expected to avoid the affected areas until dredging has ceased. Field studies, at the Alcatraz disposal site, demonstrated that fish may disperse in response to disposal events, but that they return within an hour or two; the implication is that fish schools move a short distance in response to disposal events in Central Bay (AHI 1991).

5.1.3.3 Long periods of high suspended sediments may cause gill clogging, abrasions, and physiological stress to fish. Eggs, larvae, and juvenile fish are more sensitive to suspended sediments than adults (San Francisco Estuary Project 1990; O'Connor, et al. 1976). However, some species

of estuarine fishes showed a preference for habitats with particular turbidity levels. Studies of feeding success, prey recognition, and food selectivity suggest that turbidity is a minor factor. Fish, like striped bass larvae, can detect and acquire prey in highly turbid conditions, as well as in clear water. This indicates that fish are well adapted to survival and feeding in environments characterized by variable visibility and turbidity (AHI 1991). This is particularly true for estuarine species, whose environment is affected by seasonal, daily, and tidal changes, all of which may cause changes in the concentration of suspended solids.

5.1.3.4 Herring have been reported to spawn along the Oakland-Alameda waterfront and in the Oakland Inner harbor during 1987-1990 (Spratt 1987, 1988, 1989, 1990). The peak herring spawning season is typically from December 1st to March 1st. Herring spawn in the shallow intertidal areas of the Inner Harbor channel. Herring eggs may be adversely affected by increased suspended sediment loads during dredging. The dredging could result in a smaller area used for spawning, because herring may avoid the disturbance caused by the dredging. The affected area in the vicinity of the dredging site is relatively small, and the areas used for spawning vary from year to year. Since the proposed limited 38-foot channel deepening project is scheduled to be completed before December 1992, no significant adverse impacts to the herring fishery are anticipated.

5.1.3.5 Wildlife. Adverse effects of the dredging activity on common waterbird species are not expected to be significant. Waterbirds that use the Harbor area may be temporarily impacted during dredging. Large areas of open water habitat are available nearby, and birds would be able to return to the Harbor after dredging is completed.

5.1.3.6 Threatened and Endangered Species.

(1) The California Least Tern. The least tern colony site is located at the Alameda Naval Air Station. The Naval Air Station serves as an active base for both aircraft and ocean-going vessels. It is bounded by water on three sides; Oakland Inner Harbor channel lies to the north. The least tern nesting colony is considered to be the principal northern California nesting colony of the species. No direct effects upon the nesting site would occur from project construction. Temporary increases in turbidity would occur at the dredging site and a short term increase in dredging equipment vessel activity would occur in the estuary. Per the SEIS (COE 1988), consultation with the U.S. Fish and Wildlife Service, in accordance with Section 7 of the Endangered Species Act concluded with the Biological Opinion that dredging in the Oakland Inner Harbor is not likely to jeopardize the continued existence of the least

tern.

(2) Winter-run Chinook Salmon. The Inner Harbor channel is not an area frequented by adult chinook. They typically concentrate in the waters around Angel Island and Tiburon (COE 1991). No impacts to the threatened winter-run chinook salmon are expected while dredging is in progress from September to October, since the salmon adults are present in the Bay from November through May (with peak numbers present from December through January) and the smolts migrate through the Bay from November through May (with peak abundance occurring from January through April (FWS 1992). Further, since the amount of dredged sediment that is returned to the dredging site water, due to the dredging process, is very limited, and since chemical constituents associated with the sediment particles will likely stay bound to the particles and not become biologically available (COE 1991), there is little potential that winter-run chinook salmon might bioaccumulate chemical constituents.

(3) California brown pelican and American peregrine falcon. No impacts are anticipated either at the Oakland Inner Harbor channel site or at the Alcatraz aquatic disposal site.

5.1.4 Air Quality and Noise.

5.1.4.1 Air quality studies were conducted as part of the Port of Oakland's proposed (Leiken 1992) deepening of the Inner Harbor channel to -38 feet MLLW. These studies, which utilized the EPA Air Pollutant Emission Factors (AP-42), are applicable to the proposed limited 38-foot Inner Harbor channel deepening project, and their results have been incorporated into this EA. The study concluded that emissions from dredging equipment (including tug boat emissions) would be well below 1% of the Alameda County total emissions and therefore, air quality impacts from dredging are not expected to be significant.

5.1.4.2 With respect to noise impacts, the area surrounding the Oakland Inner Harbor is predominantly industrial, with no nearby sensitive receptors, therefore, the proposed project is not expected to have significant noise impacts.

5.1.5 Socioeconomic Environment.

5.1.5.1 Beneficial economic impacts would occur as a result of deepening the Inner Harbor channel to -38 feet MLLW. A recent forecast indicates that the Port of Oakland would experience continual, but moderate growth. The forecast applies to the total Port of Oakland maritime activity adjacent to the entire Oakland harbor. This continued moderate growth would be sustained by the growth in the U.S./Asia trade, and in the attractiveness and strength of

the local cargo market. The most likely forecast anticipates cargo volumes increasing from 15,300,000 revenue tons in 1991 to 16,300,000 revenue tons by the year 1994. This forecast assumes that: the proposed limited 38-foot project is implemented; no major disruptions occur to agricultural production; all carriers presently serving Oakland remain at the Port; and that there are no major changes in the Port's competitive position, or in the competitive dynamics of the market (Port 1992).

5.1.5.2 In 1994, at the medium projected tonnage throughput, total maritime operations at the Port of Oakland would generate over 9,800 direct and induced jobs with an associated $445,000,000 in personal income (includes re-spending affect). Over 198,000 related jobs would be generated through the Port. Total maritime operations would generate over $800,000,000 in business revenue and over $39,000,000 in potential state and local tax revenue (Port 1992).

5.1.5.3 Maritime operations at both the APL Terminal and the Howard Terminal would account for a portion of the Port's total potential economic activity in 1994. For example, the two terminals would generate 2,100 direct and induced jobs with an associated $93,400,000 in personal income (includes re-spending affect). Over 49,000 related jobs would be generated. Maritime activities at the two terminals would generate over $192,000,000 in business revenue and over $8,000,000 in state and local tax revenue. (Port 1992).

5.2 Alcatraz Disposal Site; Port Sonoma - Marin Drying Site, and Redwood Landfill Site.

5.2.1 Turbidity; Sediment Transport; and Bathymetric Changes.

5.2.1.1 Disposal of the dredged material, which is suitable for unconfined aquatic disposal at Alcatraz, is not expected to have a significant impact on the suspended sediment load. The aquatic disposal of dredged material has a temporary, minor impact on suspended sediment concentrations in the water column. Only a small amount of the material, consisting of some of the fine fractions, remains in the upper water column at the disposal site. Sediment plumes created by disposal of dredged material have been found to dissipate rapidly (COE 1976; SAIC 1987; San Francisco Estuary Project 1990).

5.2.1.2 Since the Alcatraz site is dispersive, a portion of the sediment disposed there will be transported from the site. Disposal of dredged material accounts for a relatively small proportion of sediment movement in the Bay (COE 1988). Viewed in the context of ongoing dredged

material disposal operations from other sources, and the large volume of sediment contributed by natural Bay estuarine processes, the dispersion related impacts from disposal of the estimated 542,000 cys of material, generated by the proposed project, are not expected to be significant.

5.2.1.3 Since the quantity of material (i.e. 541,000 cys) to be disposed at Alcatraz is within the total two month (i.e. September = 300,000 cys and October = 1,000,000 cys) RWQCB seasonal budget, and disposal of dredged material from the limited 38-foot project would be timed so as to not exceed the monthly budget, no significant impacts to the disposal site bathymetry are anticipated. No known other dredging project would be precluded, or delayed, from disposing dredged sediments at Alcatraz.

5.2.2 Sediment and Water Quality.

5.2.2.1 Composite area sample test treatments of the Oakland Inner Harbor sediments and the reference sediment treatment R-AM (Alcatraz Environs sediments), were tested for physical and chemical characteristics, water column acute toxicity effects, deposited sediment acute toxicity, and bioaccumulation potential.

5.2.2.2 Physical and chemical analyses of sediment samples consisted of grain size, TVS, TOC, oil and grease, TPH, metals (including EPA priority pollutant metals), PAHs, chlorinated pesticides, PCBs, and butyltin compounds. These physical and chemical test data were used in the support of the toxicological and bioaccumulation testing.

5.2.2.3 The following biological effects tests were conducted:

(1) To evaluate water column biological effects, suspended particulate phase (SPP) bioassay tests were conducted using the mysid shrimp, Holmesimysis sculpta, the speckled sanddab (flatfish), Citharichthys stigmaeus, and larvae of the Pacific oyster, Crassostrea gigas.

(2) To evaluate acute toxicity of deposited sediments, 10 day exposure solid phase tests were conducted using the bentnose clam, Macoma nasuta, the polychaete worm, Nephtys caecoides, the speckled sanddab, Citharichthys stigmaeus, and the amphipod, Rhepoxynius abronius.

(3) Bioaccumulation potential was evaluated by exposing the bentnose clam, Macoma nasuta, and the polychaete, Nephtys caecoides exposed to solid phase sediments for 28 days, and then measuring the contaminants of concern present in their tissue.

5.2.2.4 Following is a summary of the test results:

5.2.2.5 TOC values ranged from 0.07%, in the reference R-AM, to 1.35%, in the top 12 inches of I-C25. The lowest TOC value for channel sediments was 0.20%, for I-C15. The COMPs, and their respective core stations, all had TOC concentrations that were equal to or greater than concentrations in the R-AM. In general, higher TOC values were found in the fine-grained sediment. Core sample stations with more than 50% fine-grained sediment also had more than 0.50% TOC. The reference sediment R-AM was only 2% fine-grained sediment.

5.2.2.6 TVS values ranged from 2.03%, in I-C8 and I-C10 sediments, to 10.6%, in the top 12" of I-C25. All COMPs, and their respective cores, had greater concentrations of TVS than the 2.13% for the R-AM reference sediment. Similar to TOC, TVS concentrations were higher in stations containing fine-grained sediments.

5.2.2.7 Oil and grease concentrations ranged from 14 ppm, in core sample Station I-C30, to 245 ppm, in I-C29, as compared to 13 ppm in the R-AM reference.

5.2.2.8 TPH concentrations ranged from below detection limits of 0.6 ppm in R-AM sediments and 0.8 ppm in I-C30 to 181 ppm in I-C29. Sediment samples with the highest concentrations of oil and grease also had the highest concentrations of TPH.

5.2.2.9 Total PAH consists of low molecular weight PAHs (LPAH) and high molecular weight PAHs (HPAH). The PAHs in Oakland Inner Harbor sediments are predominantly (85% to 95%) HPAH. Total PAH concentrations ranged from 420 ppb, in sediment from I-C21, to 31,880 ppb, in the top 12 inches of Station I-C35. All COMPs, and their respective stations, had total PAH concentrations exceeding that in the reference R-AM (118 ppb). Generally, the sediment samples that contained greater than 50% fine-grained material also had the highest concentrations of LPAH and HPAH.

5.2.2.10 Eight of the 20 chlorinated pesticide compounds had at least one value greater than detection limits in the 42 Oakland Inner Harbor samples. Only 4,4'-DDD, 4,4'-DDE and Dieldrin were found in more than one sample; and only the first two compounds had any measured values much above the detection limits. No pesticide compounds were above detection limits in the reference sediment R-AM.

5.2.2.11 Aroclor-1254 was the only PCB that had values above the detection limit. Detected concentrations of Aroclor-1254 ranged from 64 ppb, in I-C10, to 410 ppb in I-C17. Aroclor-1254 at the R-AM reference sediment was undetected at 24 ppb. All COMPs, and 15 of their respective 29 stations, had concentrations of Aroclor-1254 that were

elevated above the R-AM. Concentrations at the other 14 stations were all below detection limits.

5.2.2.12 Ten metals were measured in the Oakland test sediment and reference sediment. Metal concentrations were measured in mg/kg (ppm) dry weight. All ten metals exist most places in the natural environment, therefore, the metal concentration for each sediment, including the reference sediment R-AM, are compared to a typical shale soil sediment.

5.2.2.13 Concentrations of silver (Ag) ranged from 0.09 ppm, in COMP V replicate 2 and station I-C15 sediments, to 0.87 ppm in station I-C29, a 9.6 fold difference. All COMPs, and their respective stations, had Ag concentrations above R-AM. All sediment treatments (sediment samples evaluated), except two, had Ag concentrations greater than that of typical shale soil (0.1 ppm).

5.2.2.14 Concentrations of arsenic (As) ranged from 3.35 ppm, in I-C10, to 12.1 ppm in I-C26, a 3.6 fold difference. The reference sediment R-AM had As concentrations (13.2 ppm) above all project channel sediment. All sediment treatments, except ten, had As concentrations greater than that of typical shale soil (6.6 ppm).

5.2.2.15 Concentrations of cadmium (Cd) ranged from 0.10 ppm, in I-C21, to 0.99 ppm in I-C29, a 9.9 fold difference. Only COMP III had Cd concentrations above R-AM (0.35 ppm). COMPs I and II, and their respective stations, all had Cd concentrations below R-AM. Stations I-C28, I-C28 dup, and I-C29 in COMP III; stations I-C9, I-C12, I-C31, I-C32, and I-C34 in COMP IV; station I-C18 in COMP V; and station I-C17 in COMP VI, had Cd concentrations above R-AM. Twelve channel sediment treatments had concentrations greater than that of typical shale soil (0.3 ppm).

5.2.2.16 Concentrations of chromium (Cr) ranged from 186 ppm, in I-C19, to 955 ppm in I-C11, a 5.1 fold difference. All of the COMPs, and their respective stations, had Cr concentrations exceeding the 121 ppm concentration found in R-AM sediment, and the 100 ppm concentration in typical shale oil.

5.2.2.17 Concentrations of copper (Cu) ranged from 20.6 ppm, in I-C15, to 174.3 ppm in the COMP I duplicate, an 8.5 fold difference. All COMPs, and their respective stations, had Cu concentrations above R-AM (11.4 ppm). Thirteen channel sediment treatments had concentrations of Cu above the typical shale soil concentration of 57 ppm.

5.2.2.18 Concentrations of mercury (Hg) ranged from 0.085 ppm, in I-C8 sediments, to 1.280 ppm in I-C29 sediments, a 15 fold difference. All COMPs, and their respective

stations, had Hg concentrations exceeding the 0.048 ppm concentrations found in the R-AM sediment. Ten Oakland Harbor sediment treatments had concentrations of Hg that exceeded the typical shale soil concentration of 0.4 ppm.

5.2.2.19 Concentrations of nickel (Ni) in sediment samples ranged from 57.3 ppm, in I-C21, to 113.8 ppm in I-C12, a 2 fold difference. All COMPs, and their respective stations, had Ni concentrations above R-AM (38.8 ppm). Sixteen sediment treatments exceeded the typical shale soil concentration of 95 ppm.

5.2.2.20 Concentrations of lead (Pb) in sediment treatments ranged from 12.0 ppm, in I-C8, to 79.3 ppm in I-C17, a 6.6 fold difference. All COMPs, and their respective sediment treatments, had Pb concentrations exceeding the R-AM sediment (11.0 ppm). All but 8 sediment treatments had Pb concentrations exceeding the typical shale soil concentration of 20 ppm.

5.2.2.21 Concentrations of selenium (Se) were below the detection limit value of 0.08 ppm in 11 of the 42 channel sediment treatments and in the reference sediment R-AM. Se concentrations ranged up to 0.34 ppm, in the top 12 inches of I-C25. No sediment treatments had a Se concentration that exceeds the typical shale soil concentration of 0.6 ppm.

5.2.2.22 Concentrations of zinc (Zn) ranged from 58.8 ppm, in I-C15 sediments, to 216.0 ppm in I-C29, a 3.7 fold difference. All COMPs, and their respective sediment treatments, had Zn concentrations above that found in the reference R-AM (35.4 ppm). Seven channel sediment treatments had Zn concentrations below the shale soil concentration of 80 ppm.

5.2.2.23 Monobutyltin (MBT) concentrations in sediments ranged from below detection limits of 0.4 ppb for R-AM and I-C11 and 0.6 ppb for I-C19 and I-C21, to 5.8 ppb in I-C29. All COMPs, and their respective stations, had concentrations of MBT that were at or above the concentrations in the reference R-AM. Dibutyltin (DBT) concentrations ranged from 1.2 ppb, at I-C19, to 40.1 ppb in I-C17 sediments. All COMPs, and their respective stations, had DBT concentrations exceeding the concentrations found in R-AM. Tributyltin (TBT) concentrations in the channel sediment treatments ranged from 2.4 ppb, in I-C19, to 44.5 ppb in I-C17. All of the COMPs, and their respective sediment treatments, had TBT concentrations above the 1.0 ppb found in R-AM.

5.2.2.24 According to the "Green Book", sediment chemistry results are not intended to evaluate the suitability of sediments for unconfined aquatic disposal. They are to provide a basis for determining the contaminants in the

sediment treatments (Oakland Inner Harbor COMPs I to VI) that show signs of potential biological effects. Sediment chemistry results are used in conjunction with toxicity tests and bioaccumulation results to evaluate appropriate dredged sediment disposal alternatives.

5.2.2.25 Discussion. The tiered approach to evaluating the potential impacts from unconfined aquatic disposal of dredged material consists of a series of tests and decision modules (determinations of compliance) to guide the evaluation of potential impacts from dredged sediment. Evaluation of the Oakland Inner Harbor sediments follows the Tier III guidelines of the 1991 "Green Book", which require assessment of water column toxicity, deposited sediment (solid phase) toxicity, and deposited sediment bioaccumulation. The "Green Book" requires assessment of the potential toxicity of deposited sediments by using 10 day exposure tests. The purpose of the 28 day solid phase exposure tests on Macoma and Nephthys was to provide bioaccumulation data, not acute toxicity data. The potential for bioaccumulation of contaminants in the Oakland Inner Harbor sediments, relative to the reference R-AM sediments, is measured by the number and magnitude of statistically significant elevations of bioaccumulated chemicals.

5.2.2.26 Following is a summary of the toxicological and bioaccumulation tests completed by Battelle:

(1) The SPP tests involving the 6 Oakland Inner Harbor COMP sediments showed no acute toxicity, indicating no adverse effects to water column biota.

(2) The solid phase tests indicated no statistically significant acute toxicity (relative to R-AM) would occur in deposits of sediments from COMPs I, II, III, and IV. Acute toxicity relative to the reference R-AM sediment was observed for only 1 of the 4 test organisms in COMPs V and VI.

(3) The bioaccumulation results showed that contaminants in tissues exposed to the six COMPs sediments did not exceed Food and Drug Administration (FDA) limits summarized in the "Green Book". However, elevated levels of some contaminants were recorded in the two test organisms. Relative to the reference R-AM sediment:

(a) COMPs I and II showed some differences in bioaccumulation due to slight elevations of 4 and 5 metals, respectively, TBT and 1 pesticide in COMP II, and 3 PAHs. However, the tissue concentrations of all measured constituents were 2.6 or less times greater than tissues exposed to the R-AM sediments.

(b) COMPs III and IV showed some differences in bioaccumulation due to slight elevations of 4 metals (Ni, Cr, Pb, and As), a PCB in COMP III, TBT, and 6 and 4, respectively, of the 17 PAHs. Only the PAH pyrene was bioaccumulated to greater than slight amounts in both composites.

(c) COMPs V and VI showed the most differences in tissue contaminant levels, which included, respectively, 6 and 4 metals, TBT, 7 and 10 PAHs (to 28.6 times R-AM), 2 PCBs, and 3 pesticides.

5.2.2.27 Basis for Decision. Corps determinations regarding the suitability of the Oakland Inner Harbor dredged sediment for unconfined aquatic disposal, and consideration of other project dredging and dredged material disposal strategies, were based on a general decision making framework. This decision making framework is explained in the U.S. Army Corps of Engineers General Decision Making Framework For Management Of Dredged Material - Example Application To Commencement Bay, Washington (June 1991 and available at the Corps of Engineers, San Francisco District office, 211 Main St., San Francisco, CA 94105-1905). This decision making framework includes consideration of sediment chemistry, physicochemical nature of disposal site environments (for example aquatic vs. upland, aerobic vs. anoxic), biological effects of sediment contaminants, as well as the comparison of test results from sediments to be dredged with test results from reference sediments and with established criteria. Test results are used to formulate management strategies regarding placement of dredged material in specific physicochemical disposal environments, and to determine what treatment and control methods are warranted to dispose of any contaminated sediments in an environmentally acceptable manner. Materials that are determined to be suitable for unconfined aquatic disposal at Alcatraz are judged to have no likely significant environmental impacts.

5.2.2.28 Based on the Oakland Inner Harbor sediment test results, the Corps determined that:

(1) The sediments from COMP areas I through III and most of COMP IV are suitable for unconfined aquatic disposal at Alcatraz; COMP V is marginally suitable for unconfined disposal at Alcatraz;and

(2) The sediments in the channel area represented by COMP VI are not suitable for unconfined aquatic disposal at Alcatraz.

5.2.2.29 Sediments in COMPs I and II are suitable for unconfined disposal at Alcatraz because test results showed

no water column toxicity, no deposited sediment toxicity, and only slight bioaccumulation of a few deposited sediment contaminants. For all chemical constituents the magnitude of bioaccumulation was 2.6 times or less than in the R-AM. In addition, none of the contaminants in tissues exposed to COMPs I and II exceeded FDA action limits.

5.2.2.30 Sediments in COMPs III and most of IV are suitable for unconfined disposal at Alcatraz. Both exhibited no water column or deposited sediment toxicity. No FDA action limits were exceeded by tissue concentrations. No bioaccumulation of chlorinated pesticides and LPAHs were measured. Bioaccumulation of metals, TBT, DBT, 1 PCB, and most HPAHs was slight, varying from 2 to 3 times R-AM's. Three HPAHs were bioaccumulated by Macoma from 3.5 times to 5.9 times R-AM's in COMP IV sediments, and pyrene by Nepthys to 9.5 times. In COMP III, Nepthys bioaccumulated pyrene to 10.2 times R-AM's; and Macoma bioaccumulated benzo(a)pyrene to 6.6 times. The tissue concentration of the latter is still relatively low, and only appears higher because the value in R-AM tissues is close to the detection limit.

5.2.2.31 COMP V showed no water column toxicity; but, there was toxicity for one of the four solid phase test organism. None of the contaminants in tissues of the test organisms exceeded the FDA action limits. Bioaccumulation, varying between 2 to 3.4 times greater than R-AM's, was measured for 5 metals, TBT, DBT, one PCB, and 2 HPAHs. Two other HPAHs showed bioaccumulation from 3.7 times to 4.3 times R-AM's. Bioaccumulation of benzo(a)pyrene was 6.7 times R-AM's, and dibenzo(a,h)anthracene was 7.6 times. The Corps determined that sediments from COMP V were marginally suitable for unconfined aquatic disposal at Alcatraz.

5.2.2.32 COMP VI showed no water column toxicity; however, there was toxicity for one of the four solid phase test organisms. None of the contaminants in tissues exceeded available FDA action limits. Bioaccumulation, varying from less than 2 times to 4.1 times greater than R-AM's was measured for 5 metals, 2 LPAHs, 6 HPAHs, and 3 chlorinated pesticides. The HPAH benzo(a)pyrene was bioaccumulated to 9.1 times R-AM's and pyrene to 28.6 times. Two PCBs were bioaccumulated to 5.6 times and 7.8 times R-AM tissue concentrations. The Corps determined that sediments represented by COMP VI were not suitable for unconfined aquatic disposal at Alcatraz.

5.2.2.33 The sediment test results and findings regarding suitability or unsuitability of Oakland Inner Harbor sediments for unconfined aquatic disposal at the Alcatraz site were discussed at a two day meeting of various Federal and State resource and regulatory agencies on January 22, and 23, 1992. The agencies expressed concern regarding the levels of some PAHs (benzo(a)pyrene and pyrene) exhibited by

organisms exposed to sediments from COMPs III, IV, V, and VI. In response to these concerns, the Corps modified the project to include the following (see Plates EA-2 through EA-4):

(1) Sediments from the Oakland Inner Harbor limited 38-foot channel area represented by COMPs I and II are suitable for dredging with unconfined aquatic disposal at Alcatraz;

(2) Sediments from the area of the channel represented by COMP III are suitable for dredging and unconfined disposal at Alcatraz, except the areas represented by individual sample stations I-C29 and I-C30 (where sediments have relatively high concentrations of PAH compounds) will not to be dredged and instead be avoided through channel realignment to an area already at project depth;

(3) Sediments from the channel areas represented by COMPs IV and V are suitable for dredging and unconfined disposal at Alcatraz, except for the areas represented by individual sample stations I-C9, I-C33, I-C34, I-C12, I-C13, and I-C14, which will be dredged and disposed at the approved Redwood Landfill site; and

(4) Sediments from the channel areas represented by COMP VI, COMP V stations I-C15 and I-C18, and the areas in COMPs IV and V south of the strip of sediments which will be disposed at the Redwood Landfill site, will not be dredged, because they are outside the limited 38-foot project area.

5.2.3 <u>Biological Environment.</u>

5.2.3.1 <u>Benthos</u>. Disposal of dredged material at the Alcatraz site would result in burial of benthic organisms. Burrowing species have been known to migrate through dredged material tens of centimeters deep, but only when grain size of the newly deposited sediment is similar to that of the species' normal habitat (Hirsh, et al. 1978). Recolonization of the disposed sediments depends on the contamination level of the sediments and whether the sediments are similar (e.g., grain size distribution, etc.) to those at the disposal site. Constant alteration of the substrate at the Alcatraz site has led to a highly varying benthic community structure, characterized by opportunistic species (COE 1988).

5.2.3.2 The Alcatraz site is located in a migration corridor for juvenile Dungeness crab. Juveniles pass through this area in late winter and early spring, and some could potentially be smothered or displaced during dredged material disposal. Available data indicate that adult

benthic organisms, including Dungeness crab and Crangon shrimp, can tolerate levels of suspended solids well above those measured at the Alcatraz site during disposal events (AHI 1991). Any juvenile Dungeness crab in the Central Bay should also be able to avoid the disposal site project area during disposal events. In addition, since the proposed dredged material disposal at Alcatraz is scheduled for the September to October time period, no adverse impacts on this species are anticipated.

5.2.3.3 Fish. A review of the available literature on turbidity and fish catch, by the Aquatic Habitat Institute (AHI) in 1991, concluded that it is unlikely that striped bass catch success is significantly affected by dredged material disposal at the Alcatraz site. AHI stated that some species of estuarine fishes showed a preference for habitats with particular turbidity levels. Studies of feeding success, prey recognition and food selectivity suggest that turbidity is a minor factor. Fish, like striped bass, can detect and acquire prey in highly turbid conditions as well as in clear water (AHI 1991).

5.2.3.4 Studies at the Alcatraz site, and other aquatic disposal sites, have shown that turbidity, caused by single dredged material disposal events, dissipates rapidly (COE 1976; San Francisco Estuary Project 1990).

5.2.3.5 Fishermen have perceived an increase in turbidity in the Central Bay. They hypothesize that increased turbidity acts to drive forage fish away from the area and that, consequently, larger fish leave the area in search of food (AHI 1991). The AHI report stated that disposal of dredged material at the Alcatraz site has not been studied in a manner that could allow conclusions to be drawn regarding whether any decrease in surface water transparency in Central Bay is directly related to dredged material disposal, or if dredged material disposal is related in any way to sport fish catch success in the Central Bay. The AHI report also stated that:

(1) Laboratory studies show that low level increases in turbidity should have no effect on the presence, distribution, or feeding abilities of estuarine and marine species that occupy the Central Bay.

(2) Field studies at Alcatraz show that fish may disperse in response to disposal events, but that they return within an hour or two - the implication is that fish schools move only a short distance in response to dredged material disposal events in the Central Bay.

5.2.3.6 Studies of fish eggs and larvae (including those of white perch and striped bass) show that these forms are tolerant to rather high concentrations of suspended

particles and mineral solids (AHI 1991). Therefore, it may be concluded that suspended solids concentrations generated by dredged material disposal at the Alcatraz site would not have a significant adverse impact on these early life history stages of estuarine fishes.

5.2.3.7 Adult fish, generally, possess the ability to avoid, tolerate, and/or adapt to high concentrations of suspended solids quite well (AHI 1991). Studies of the effects of suspended solids on fish, show that mortality is related to the shape, concentration, and hardness of the particles concerned, and that the primary cause of death is interruption of gas exchange across the surface of the gill (O'Connor 1977; AHI 1991). Studies on sublethal effects of suspended particles show that respiratory gas exchange impairment may begin to appear after long exposure to concentrations of mineral solids above approximately 500 mg/L and that compensatory mechanisms, such as increased red blood cell counts, could overcome the effects of reduced gas exchange at the gill (Dillon and Moore 1990; AHI 1991). In view of the fact that the discharge plume created by the disposal of dredged material at the Alcatraz site would be temporary and would rapidly dissipate, and because adult fish, generally, possess the ability to tolerate and/or adapt to turbid conditions, the limited amount of dredged material generated by the proposed project is not expected to significantly impact the fishery in the Central Bay.

5.2.3.8 Wildlife. Wildlife use of open water in San Francisco Bay is primarily limited to sea lions, seals, and waterfowl. Bay waters are used for foraging and resting by such species. In the past, dredged material disposal operations at the Alcatraz site have had no known direct impact to such species. Adverse indirect impacts associated with prey (fish) population abundance are not expected to be significant. Foraging wildlife species follow food sources, therefore displacement of the food sources simply redirects their foraging activities.

5.2.3.9 The National Park Service has reported that there is a breeding colony of black-crowned night herons (Nycticorax nycticorax) on Alcatraz Island. This species is expected to limit its foraging activities to tide pools along the shoreline of Alcatraz and other nearby islands. Disposal of dredged sediments in the open Bay near Alcatraz Island is not expected to significantly impact this breeding population of herons.

5.2.4 Threatened and Endangered Species.

5.2.4.1 Chinook salmon. A Biological Assessment of the unconfined disposal of the Oakland Inner Harbor dredged material at the Alcatraz site and potential impact to the winter-run of the chinook salmon is presented below.

5.2.4.2 <u>Direct Effects</u>. Potential direct chemical and physical impacts to the winter-run chinook salmon follow.

5.2.4.3 <u>Chemical</u>. Suspended particulate phase (SPP) toxicity testing of Oakland Inner Harbor sediments were conducted with three species of marine organisms. These organisms consisted of a juvenile flatfish (<u>Citharichthys stigmaeus</u>), a mysid shrimp (<u>Holmesimysis sculpta</u>), and larvae of the Pacific oyster (<u>Crassostrea gigas</u>). The highest concentration of suspended particulate material had no influence on the survival of the juvenile fish, no influence on the survival of oyster larvae in 4 of the 6 composite samples, and only a statistically significant effect on the survival of the mysid shrimp. In no case was the influence on the survival organisms sufficient to be able to calculate a LC50 for the suspended materials.

5.2.4.4 The most sensitive life stages tested against suspended particulate phases of Oakland sediment are the mysid shrimp juveniles and the bivalve larval test. Evaluation of the EPA Water Quality Criteria documents for zinc, show that oyster larvae are much more sensitive to zinc than are salmon smolts. Where salmon smolts show an LC50 at 1,200 micrograms per liter, the oyster larvae show a LC50 at 242 micrograms per liter. In this case the oyster larvae are at least 6 times as sensitive to zinc as are the salmon smolts. With comparable tests using salmon smolts exposed to the suspended particulate phases produced from the Oakland Inner Harbor testing, it is reasonable to presume that the salmon would show a similar sensitivity to suspended particulate material, as the juvenile fish species tested for the Oakland project (Battelle 1992a).

5.2.4.5 Past research, conducted by the Corps, indicates that most impacts associated with dredged material disposal are likely to occur on the bottom, and not in the water column (COE 1991). In addition, winter-run chinook salmon migrating into San Francisco Bay have ceased feeding (Jones & Stokes Associates, Inc., 1981), so would not likely take up chemical contaminants through their feeding. Out migrant smolts also travel through the Bay "rapidly" (Jones & Stokes Associates, Inc. 1981) and in the upper six feet of the water column. Therefore, the potential for contaminant uptake is minimal, given that sediment associated contaminants are not readily available. In addition, no impacts to the threatened winter-run chinook salmon are expected while disposal of dredged material at Alcatraz is in progress from September to October, since the salmon adults are present in the Bay from November through May (with peak numbers present from December through January) and the smolts migrate through the Bay from November through May (with peak abundance occurring from January through April. Therefore, no adverse effect to the salmon is

anticipated from the unconfined disposal at Alcatraz of the Oakland Inner Harbor limited 38-foot sediments.

5.2.4.6 Physical Effects. Increased turbidity and turbidity related effects on Bay biota has been cited as a potential physical impact related to in-Bay disposal (Gunther et al. 1990). However, previous research has shown that disposal of dredged material at the Alcatraz site contributes minimally to the total suspended sediment regime of the Bay (COE 1988). Riverine inflow and wind and wave generated resuspension of sediments contribute largely to the suspended sediment loading of Bay waters. Suspended sediments contribute to the suspended particulate loading of Bay waters, and these suspended particles augment turbidity. The influence of Bay tidal circulation, which transport sediment laden waters from the shallow areas of the Bay and Delta, back and forth across the Alcatraz disposal site, to the relatively clear waters from the Golden Gate and beyond, is overwhelmingly the most important factor affecting suspended sediment load. The turbidity attributable to the additional sediments resuspended by dredged material disposal at Alcatraz is minor (COE 1988).

5.2.4.7 Disposal of Oakland Inner Harbor dredged sediments at the Alcatraz disposal site would result in short-term increases in total suspended solids (TSS) associated with the turbidity plume. Monitoring of turbidity plumes during dredged material disposal at Alcatraz has shown that maximum turbidity occurs in bottom waters close to the disposal site. Surface waters are less turbid, and return to ambient levels within 10-15 minutes after each disposal episode. In most cases, the interval between disposal events is great enough to allow turbidity to decrease to background concentrations (Gunther, et al. 1990).

5.2.4.8 It is unlikely that the short-term physical impacts to the water column, associated with dredged material disposal at the Alcatraz site, would result in any direct adverse impact to the winter-run chinook salmon. Direct mortality of fish exposed to high concentrations of suspended particulates is due to impaired oxygen exchange from gill clogging. Total suspended solid (TSS) concentrations would need to exceed several hundred mg/l for several hours to pose a threat to the salmon. TSS concentrations exceeding several hundred mg/l for several hours is not expected for disposal of the Oakland Inner Harbor material at Alcatraz.

5.2.4.9 It is unlikely that dredged material disposal at Alcatraz would alter the natural movement or migration of adult or juvenile salmon in the Bay. Adult salmon are found throughout the Central Bay, but typically concentrate in the waters around Angel Island and Tiburon. Adult salmon are capable of avoiding areas of low dissolved oxygen, thereby

circumventing any localized disturbance and minimizing any interruption to their migration. In addition, the out-migration (from November through May) (FWS 1992) of salmon juveniles is rapid (approximately 1 week) indicating that they probably take the most direct route (WESCO 1988). The proposed dredging and dredged material disposal action is scheduled to begin in September 1992 and be completed by the end of October 1992, thus avoiding the juvenile out-migration time period. Therefore, direct physical impacts to adult or juvenile life stages of winter-run salmon in San Francisco Bay from the disposal of dredged sediment from the Oakland Inner Harbor limited 38-foot project is not anticipated.

5.2.4.10 Indirect Effects. Potential indirect effects on winter-run chinook salmon associated with the disposal of dredged material at Alcatraz may include turbidity influenced changes in foraging behavior and habitat selection. Jones & Stokes Associates, Inc., (1981) indicated that mature salmon cease feeding on their upstream migration through the San Francisco Bay estuary and, in fact, had usually ceased feeding by the time they enter the Bay. However, WESCO (1988) stated that schools of adult salmon entering the Bay may feed on anchovy (*Engraulis mordax*) and other forage fish for several days, or continue directly through the Bay and journey upstream.

5.2.4.11 If adult salmon entering the Bay have ceased feeding, then no indirect effects on foraging behavior would be expected. If adult salmon continue feeding upon entry into the Bay, then there is a question on whether disposal of Oakland Inner Harbor dredged material at Alcatraz would cause the salmon to alter their foraging behavior or decrease populations of forage species. Since the San Francisco Bay estuary is a naturally turbid system and the contribution to turbidity conditions from the disposal of sediments at the Alcatraz site is minimal (COE 1988), then it is unlikely that the short-term increases in TSS near the disposal site would influence salmon feeding behavior. It is equally unlikely that forage fish populations would be affected by short-term increases in TSS near the disposal site during disposal events. The most likely scenario would be that schools of forage fish, such as anchovies, would avoid the disposal site and turbidity plume during a disposal event and return when pre-disposal ambient conditions are re-established. Given the short time that salmon are in the Central Bay, as well as, the short-term, minor changes in water column variables that occur during dredged material disposal at the Alcatraz site, it is unlikely that disposal of the Oakland Inner Harbor sediments would alter habitat selection by adult or juvenile salmon.

5.2.4.12 Cumulative Effects. With regard to the chinook salmon winter-run, the cumulative impacts that have led to

the population decline are associated with the modification and loss of spawning and rearing habitats in the upper Sacramento River.

5.2.4.13 San Francisco Bay is a naturally turbid estuary (COE 1988) which receives an estimated annual 8 to 10 million cubic yards of sediment from the Sacramento-San Joaquin river system. The most important source of suspended sediment in Bay waters is the resuspension, by wind-induced waves and currents, of an estimated 160 to 170 million cubic yards of material annually from the shallow areas of the Bay. In view of the fact that disposal of dredged material at Alcatraz accounts for only approximately 4 million cubic yards of sediment and since it is a dispersive site, located in an area of high current energy, the disposal of Oakland Inner Harbor sediments is not expected to contribute significantly to the cumulative increase in resuspension of sediments and turbidity in the Bay.

5.2.4.14 As previously stated, any chemical constituents associated with the Oakland Inner Harbor sediments would most likely remain associated with those sediments during disposal (Gunther, et al. 1990). These chemical constituents would not, as a general rule, become biologically available to organisms in the water column and therefore, would not appreciably add to the cumulative increase in biologically available contaminants in the Bay.

5.2.4.15 Conclusion. For the reasons outlined above, disposal of dredged material at Alcatraz from the Oakland Inner Harbor 38-foot project is not expected to affect the continued existence of the winter run of the chinook salmon. Also, informal consultation with the NMFS, via the January 22 & 23, 1992 sediment sampling and test result interagency meetings, resulted in the NMFS indicating that sediment chemical constituent impacts to the winter-run salmon could be avoided by placement of the "unsuitable" material upland, and leaving other "unsuitable" material in place (i.e., the proposed project).

5.2.5 Air Quality and Noise.

5.2.5.1 Impacts to air quality resulting from dredged material disposal operations at the Alcatraz site were evaluated for the Port of Oakland by a private consultant (Leiken 1992). The results of the Port's evaluation are discussed below and have been determined applicable to the proposed project. Utilizing EPA's Air Pollution Emission Factors (AP-42), the Port determined that the only emissions associated with disposal at the Alcatraz site would be from the dredging equipment. Comparing these emissions (estimated at 61 tons/year) to the total San Francisco County NOx emissions (30,716 tons/year) indicates that there

would be a less than significant regional impact (0.2%). Carbon monoxide and HC emissions would also be below the 1% significance threshold. The emissions would not be concentrated in any one location, so there would not be any impact to sensitive receptors. With respect to tug boat vessel delays due to waiting for tides at Port Sonoma - Marin, there could be a potential to generate an excess of emissions in one location. This could potentially produce carbon monoxide concentrations in excess of State standards. This potential adverse impact will be mitigated by scheduling tug operations to avoid unnecessary idling at Port Sonoma - Marin.

5.2.5.2 Barging the estimated 21,000 cys of dredged material to Port Sonoma - Marin for off-loading and drying would involve clamshell and dredged material spreading equipment emissions. Based upon the analysis completed for the Phase I project of 520,000 cys (HLA 1991), emissions from off-loading equipment should be far below the significant threshold of 1% of County emissions. There are no sensitive receptors at the dredged material drying site. Thus, emissions from the equipment will not be a significant impact.

5.2.5.3 To date, dredging (whether from freshly dredged material or from dredged material loaded into a barge, which was moored in the Oakland Harbor for 3 months) of Oakland Inner Harbor has not generated known odor problems. Dredged material drying at Port Sonoma - Marin is not expected to cause a significant odor impact. Also, with respect to dust emissions at the Port Sonoma - Marin drying site, because of the clay and moisture content of the sediment, fugitive dust would not be a problem as the dredged material drys and when it is transported to the landfill site.

5.2.5.4 Redwood Landfill currently hauls sediments from Port Sonoma - Marin. The truck hauling of sediments is permitted to occur 6 days per week during the summer months between the hours of 3:00am and 1:30pm to minimize conflicts with traffic on Highway 101. The trucks travel on Highways 37 and 101 between the two locations. Using an estimated 20 cys per truck load factor, the Oakland Inner Harbor sediments are expected to be transported to the Redwood Landfill site over the summer months. This is an existing operation and does not constitute an increase in traffic or vehicle emissions. Therefore, dump truck traffic impacts are not expected to be significant.

5.2.5.5 Given the ambient noise levels at the Alcatraz and Port Sonoma - Marin dredged material drying yard, and the attenuation of noise over distance, dredging equipment traveling through the Bay to the disposal sites would not cause any noticeable noise increase at receptors along the shoreline. Thus, noise will not be a significant impact.

5.2.5.6 Noise, from localized sources, typically decreases by about 6 dBA with each doubling of distance from source to receptor (exclusive of barriers, such as structures, trees, scrubs, or topographic relief). Assuming a noise level of 80 dBA (typical of an earthmoving scraper) and the 6 dBA attenuation rate, a noise level of about 55 dBA would occur at approximately 2,000 feet from the source. Therefore, noise from the Port Sonoma - Marin drying yard equipment, as well as from the dump trucks would only cause localized impacts rather than regional impacts, and is similar to noise from on-going operations at both Port Sonoma - Marin and Redwood Landfill. There are no sensitive receptors at the Port Sonoma - Marin drying yard. Thus, noise from earthmoving equipment and dump trucks would not cause a significant impact.

5.2.6 <u>Socioeconomic Environment</u>.

5.2.6.1 <u>Navigation</u>. Disposal of the estimated 541,000 cys of dredged material at Alcatraz would result in the temporary increase of an estimated 180 self-propelled hopper dredge vessel round trips over a period of 35 days. Also, disposal of the estimated 21,000 cys at the Port of Sonoma re-handling facility, for eventual disposal at the Redwood Landfill site, would result in an estimated temporary increase of 3 tug/barge (based on 2 barges per tow) round trips per day for 4 days. In 1988, the most recently recorded vessel trip statistics, there were 188 tug/barge round trips along the Petaluma River. On this basis, the vessel trips needed to dispose of the "unsuitable for unconfined aquatic disposal" material would represent about 6% of the annual Petaluma River tug/barge vessel traffic. Dredging and disposal operations would be carried out during daylight, as well during the night. Impacts to navigation are expected to be minor.

5.2.6.2 <u>Commercial and Sport Fishing</u>. The use of the Alcatraz site for disposal of dredged material has been on-going for a period of years (e.g., formally since 1973). Disturbances to fishing in the vicinity of the Alcatraz site have occurred previously and certain marine species, less accustomed to the fine grained sediment, would temporarily avoid the area of disposal. Such avoidance would not likely affect the fish catch success of certain sport fish (e.g., striped bass) (COE 1988). As stated earlier, the Aquatic Habitat Institute reported that fish may disperse in response to dredged material disposal events, but that they return within an hour or so; the implication being that fish schools move only a short distance in response to disposal events in the Central Bay (AHI 1991). Therefore, because daily dredged material disposal operations would be relatively infrequent, and since increased turbidity at the Alcatraz site shows little correlation to fish catch

success, disposal of dredged material at the Alcatraz site is not expected to significantly impact commercial or sport fishing activities.

6.0 COMPLIANCE WITH FEDERAL, STATE, AND LOCAL PLANS AND POLICIES.

6.1 Clean Water Act, as amended (PL 95-217).

6.1.1 Section 401 of the Clean Water Act. Pursuant to Section 401 of the Clean Water Act (CWA), the Corps of Engineers, on April 3, 1992, requested State water quality certification from the California State Water Quality Control Board - San Francisco Bay Region, for the proposed project. Water quality certification from the RWQCB is anticipated by June 18, 1992.

6.1.2 Section 404 (b) (1) of the Clean Water Act, Alternatives Analysis. Since the proposed Oakland Inner Harbor limited 38-foot channel project includes the discharge of dredged material into waters of the United States, a section 404 (b) (1) alternatives analysis has been prepared and is included within the body of this EA.

6.1.3 The proposed project was modified from its original design to avoid and minimize impacts to waters of the U.S. while still accomplishing the project purpose. The extent of the proposed project was minimized to decrease the amount of dredged material that would be disposed at the Alcatraz site. The channel alignment was modified to avoid sediments unsuitable for unconfined aquatic disposal. Further, only material suitable for unconfined aquatic disposal will be disposed at Alcatraz. All unsuitable material (for unconfined aquatic disposal) will be disposed at the approved Redwood Landfill. Physical, chemical, toxicological, and bioaccumulation testing was completed on project sediment samples to ensure their suitability for unconfined aquatic disposal. A biological assessment was prepared and concluded that disposal of dredged material at the Alcatraz site would not adversely affect endangered or threatened species. Further, the proposed project design and disposal procedures were determined to be the most economical in view of the project purpose.

6.1.4 Based on the above, the Corps of Engineers has determined that the proposed project: (1) is the least damaging practicable alternative; (2) will not result in significant degradation of waters of the U.S.; and (3) is in the public interest (see EA paragraph 1.3 Purpose and Need for the Proposed Action). Therefore, the proposed project is in compliance with Section 404 of the Clean Water Act, as amended.

6.1.5 The Redwood Landfill, Inc. by letter dated February 26, 1992, has requested RWQCB approval to accept the unsuitable for unconfined aquatic disposal dredged sediment from the limited 38-foot project (reference EA paragraph 4.4.5).

6.2 Clean Air Act, as amended (PL 91-604). In accordance with this act, as amended, the Corps of Engineers has determined that the proposed dredging and disposal activities at the Alcatraz Island disposal site will have no adverse effect on the future air quality of the project and disposal areas and are therefore in compliance with this act. Disposal of the dredged material deemed unsuitable for unconfined aquatic disposal will be at the approved Redwood Landfill site. Processing and transport of this material will be according to conditions specified under permits issued to Port Sonoma - Marin and Redwood Landfill. It is expected that regulated activities related to the disposal of the dredged material at the Redwood Landfill will have no adverse effect on the future air quality of the disposal related areas and are therefore in compliance with this act.

6.2.1 Section 176(c)(1) of the Clean Air Act establishes the requirement for the conformity of Federal actions to state-developed and EPA approved air quality plans. The proposed project conforms to the California State Implementation Plan, since it will not:

cause or contribute to any new violation of any standard in any area;

increase the frequency or severity of any existing violation of any standard in any area; or

delay timely attainment of any standard or any required interim emission reductions or other milestones in any area.

6.3 National Historic Preservation Actof 1966, as amended (PL 89-665). In accordance with this act, archival and on-site research by Corps of Engineers cultural resource staff has determined that no physical structures or remains in the area of this project (cultural resources within the Oakland Inner Harbor channel improvement areas and at the Alcatraz disposal site were discussed in the prior Oakland Harbor environmental impact statements) are eligible for inclusion in the National Register for Historic Places, nor would there be any indirect effects on such property. Therefore, the Corps is in compliance with this Act.

6.4 Fish and Wildlife Coordination Act of 1958, as amended (PL 85-624). In accordance with this Act, formal coordination with the U.S. Fish and Wildlife Service was conducted in the form of a Planning Aid Letter (dated March

5, 1992), and all information and recommendations therein have been taken into consideration in the preparation of this environmental assessment.

6.5 <u>Coastal Zone Management Act of 1972, as amended (PL 92-583)</u>. Under this Act, the Corps is responsible for managing its actions in the coastal zone, to the maximum extent practicable, in a manner which is consistent with National Oceanic and Atmospheric Administration (NOAA) approved state management programs. The relevant state program for the Oakland Inner Harbor limited 38-foot project is the San Francisco Bay Plan, which is administered by the BCDC.

6.5.1 In accordance with this Act, the Corps of Engineers has determined that the proposed project is consistent, to maximum extent practicable, with the following Bay Plan Findings and Policies:

(1) Ports - The Seaport Plan provides for the expansion of port facilities at Oakland which includes channel deepening. The proposed project will allow for development of port facilities with the least potential adverse environmental impacts.

(2) Dredging - There are several Bay Plan dredging policies relevant to the proposed project. One policy is to dispose of dredged material in one of the following ways: (a) on dry land; (b) placement as fill in approved fill projects; (c) barging or piping to suitable disposal sites in the ocean; or (d) if no other alternative is feasible, then disposal at designated in-Bay sites where the maximum possible amount would be carried out the Golden Gate. Alternative dredged material disposal sites have been considered for the proposed limited 38-foot Inner Harbor channel project. For the reasons stated in the EA, the only feasible dredged material disposal site alternative is to place a portion of the material at the Port Sonoma - Marin drying ponds (a BCDC permitted operation) for eventual disposal at an upland site (Redwood Landfill, which is outside BCDC jurisdiction) and the remainder at the Alcatraz aquatic in-Bay site.

Another Bay Plan policy is to find new or improved methods of dredged material disposal that will provide for construction of major new shipping channels. The policy also recognizes that the study and implementation of new or improved methods takes time to accomplish. Such efforts are being conducted as part of the LTMS, which is scheduled for completion in 1994.

The proposed project has been designed so as not to undermine the stability of any adjacent dikes and fills. Also, the proposed project is not expected to damage the

Merritt-Posey ground water aquifer.

Lastly, adequate sediment sampling and testing has been performed to determine which sediments are suitable for unconfined aquatic disposal at Alcatraz. Dredging and disposal of the Oakland Inner Harbor channel will be consistent with the requirements of the RWQCB and EPA.

6.5.2 This Consistency Determination will be provided to the BCDC for their concurrence.

6.6 Endangered Species Act of 1973, as amended (PL 93-205). Pursuant to this Act, a species list has been requested from the U.S. Fish and Wildlife Service and the National Marine Fisheries Service. In accordance with Section 7 (c) of this Act, a biological assessment has been prepared, and incorporated into this EA, to analyze the potential effects of the proposed in-Bay disposal of Oakland Inner Harbor sediments on the threatened winter-run chinook salmon. The conclusion of this biological assessment (see EA paragraphs 5.2.4 to 5.2.4.15) is that disposing of dredged sediments from Oakland Inner Harbor at the Alcatraz disposal site will have no effect on the continued existence of the winter-run chinook salmon.

6.7 Local Plans and Policies. Port Sonoma - Marin is designated a marina in the BCDC Bay Plan and Sonoma County land use is recreation/agriculture. Redwood Landfill is outside BCDC jurisdiction, and operates in compliance with a Marin County Waste Facilities Permit.

7.0 PUBLIC PARTICIPATION. The Environmental Assessment has been circulated to over 1,250 Federal, State, and local agencies, organizations, groups, and interested individuals (a mailing list is available in the office of the Corps of Engineers, San Francisco District, 211 Main St., San Francisco, CA 94105-1905) for a 30 day comment period. Circulation of the Environmental Assessment also serves the public notification requirement for Section 401 (CWA) certification of the proposed disposal of dredged material into waters of the U.S. In addition, a Public Meeting, to receive comments on the proposed project, is scheduled for Monday, April 20, 1992, at 7:30pm, in Room 173 of the Joseph P. Bort Metro Center, 101 8th Street, Oakland, CA 94607. Comments received on the EA and at the Public Meeting will be evaluated and incorporated into the EA.

8.0 CONCLUSION.

8.1 The proposed Oakland Inner Harbor limited 38-foot channel deepening project is expected to have short term, temporary, minor adverse impacts on air and noise quality,

water and sediment quality, biological resources, commercial and sport fishing, and navigation. Mitigation of adverse impacts includes disposal of sediment, unsuitable for unconfined aquatic disposal, at an approved upland site, and timing the project construction (i.e. from September, 1992 through October, 1992) to avoid impacts on sensitive life stages of in-Bay species. Cumulative direct and indirect adverse impacts are not expected to be significant. The proposed project will have beneficial navigation and socio-economic impacts for the Port of Oakland and the Bay area in general.

8.2 Based upon a comparison between the proposed Oakland Inner Harbor limited 38-foot channel deepening project and the recommended plan presented in the Final Feasibility Study and Environmental Impact Statement, Oakland Inner Harbor, California Deep-Draft Navigation, dated November, 1984, it is determined that the environmental impacts of the limited 38-foot channel deepening project are closely related to, although reduced, and not significantly different from, that presented in the Feasibility Study and Final Environmental Impact Statement. Therefore, a supplement to the Final EIS is not required.

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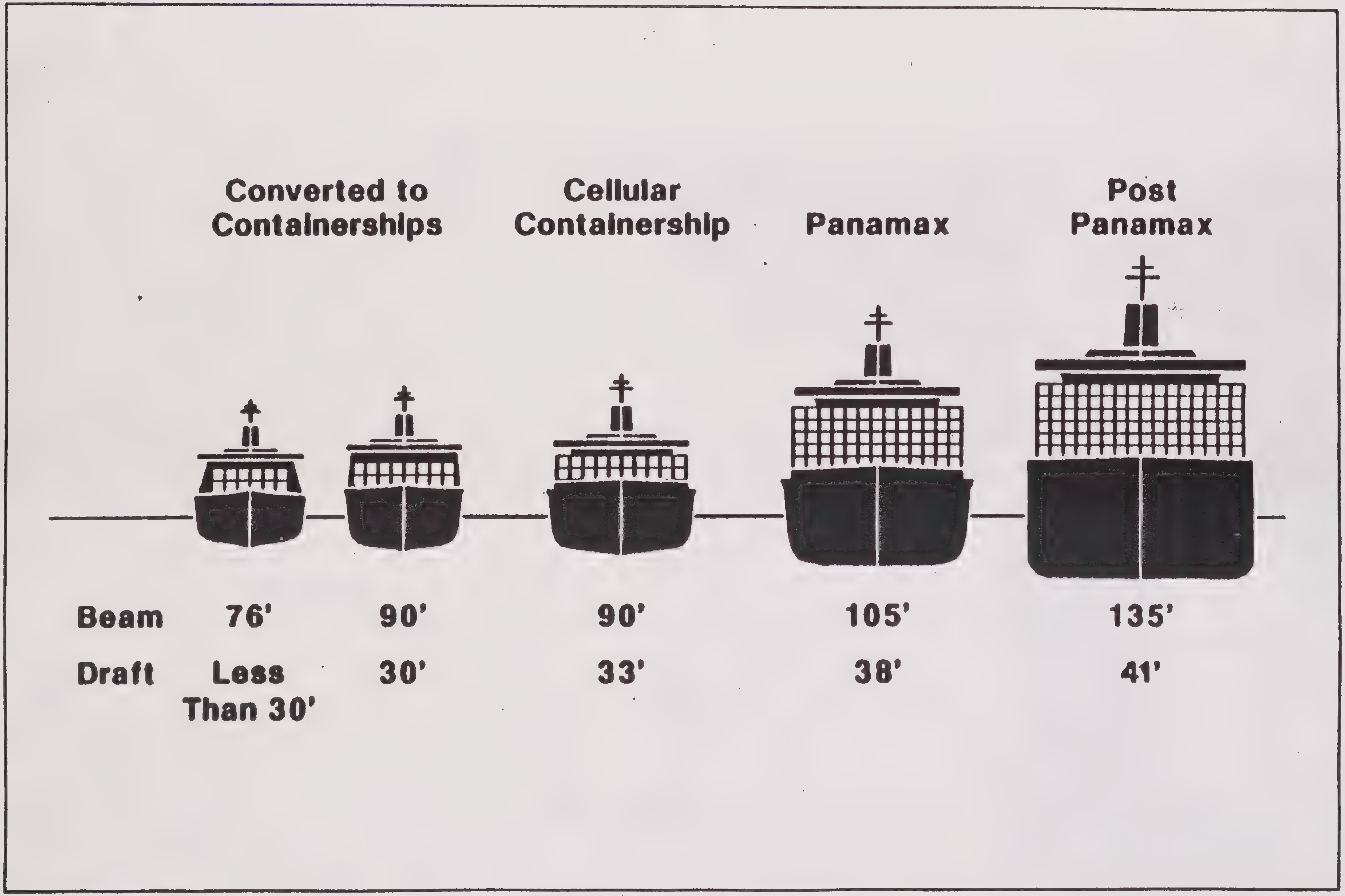


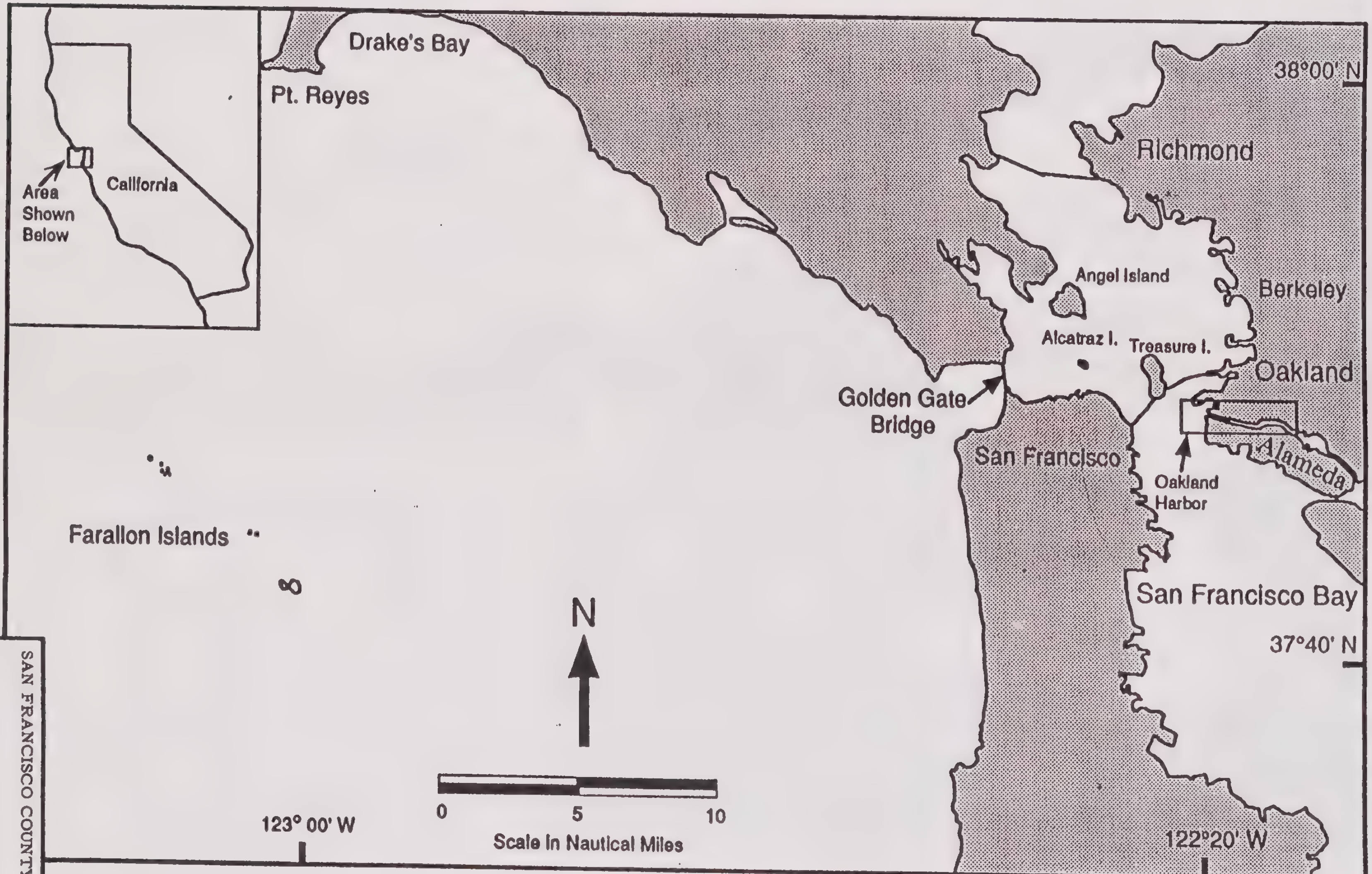
PORT OF OAKLAND

Deep-Draft Navigation
Improvement Project
Phase I SEIR/EIS

Containership Evolution - Beam and Draft

FIGURE 4

STUDY AREA



SAN FRANCISCO COUNTY CALIFORNIA

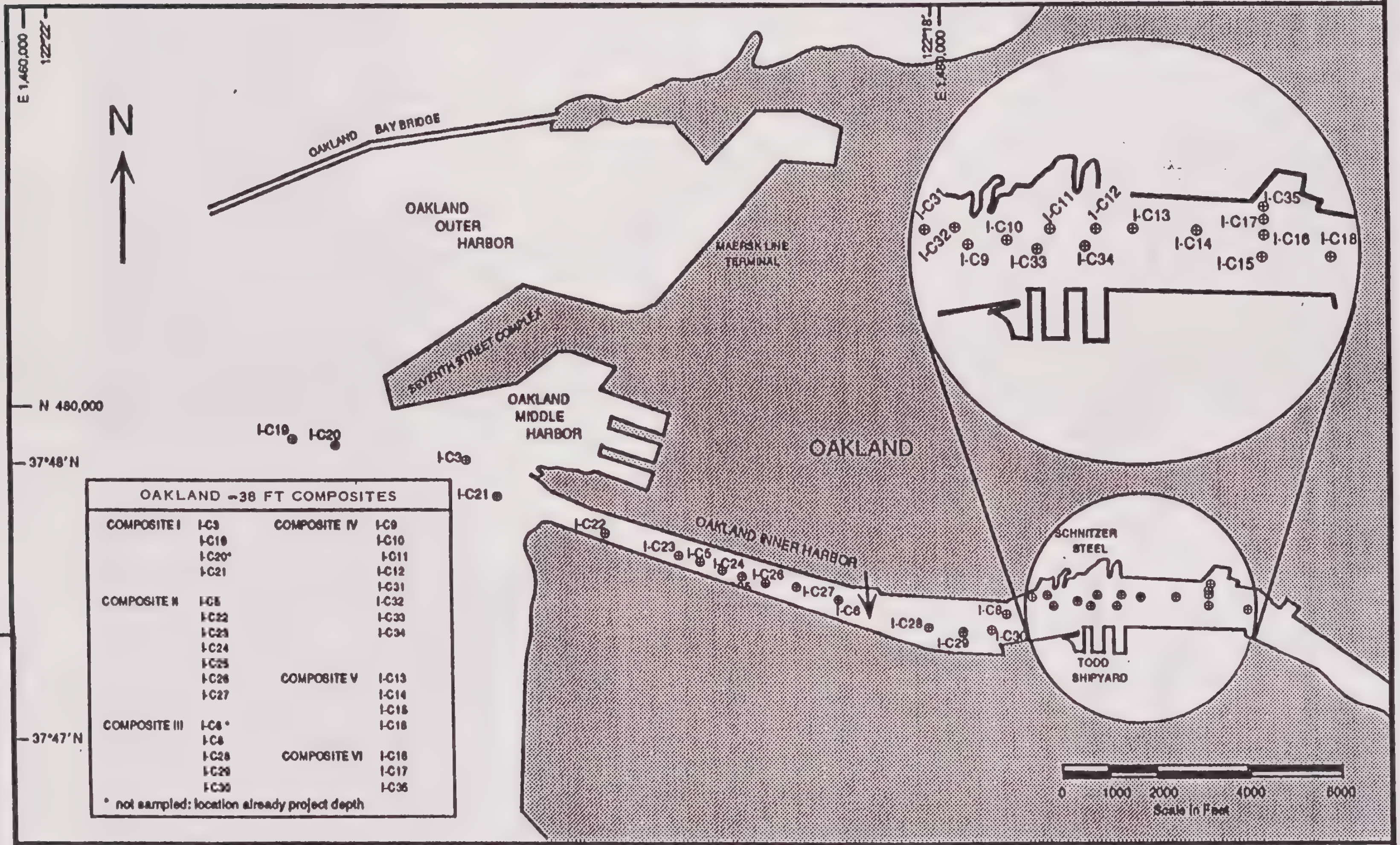
OAKLAND INNER HARBOR

LIMITED -38 FOOT PROJECT

U.S. ARMY ENGINEER DIST., SAN FRANCISCO, C OF E
DRAWN:
TRACED: TO ACCOMPANY REPORT FILE NO.
CHECKED: DATED

FIGURE 1

SEDIMENT SAMPLING STATIONS



OAKLAND -38 FT COMPOSITES			
COMPOSITE I	I-C3	COMPOSITE IV	I-C9
	I-C19		I-C10
	I-C20*		I-C11
	I-C21		I-C12
			I-C31
COMPOSITE II	I-C5		I-C32
	I-C22		I-C33
	I-C23		I-C34
	I-C24		
	I-C25		
	I-C26	COMPOSITE V	I-C13
	I-C27		I-C14
			I-C15
COMPOSITE III	I-C6 *		I-C16
	I-C8		
	I-C28	COMPOSITE VI	I-C18
	I-C29		I-C17
	I-C30		I-C35

* not sampled: location already project depth

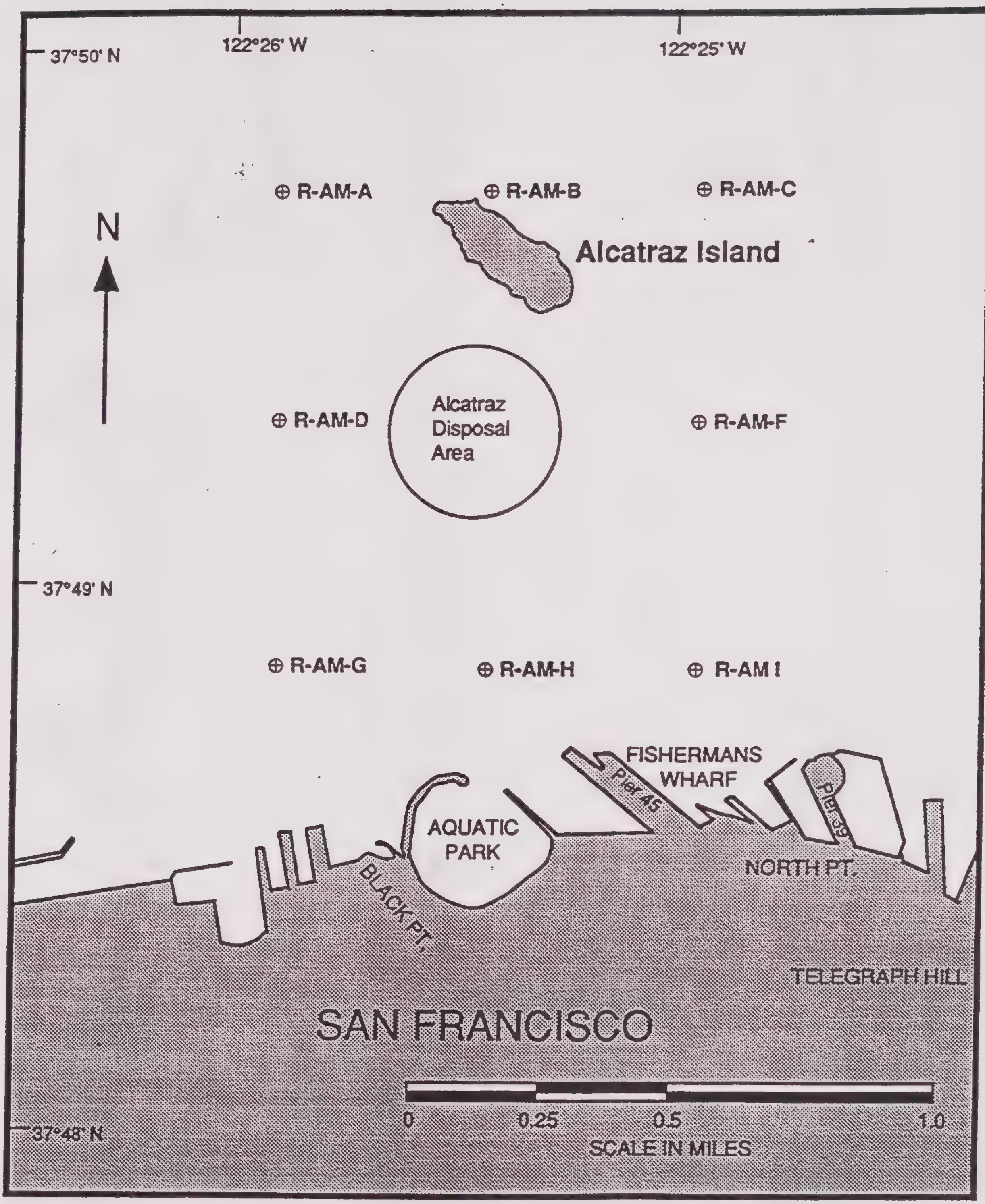
SAN FRANCISCO COUNTY CALIFORNIA

OAKLAND INNER HARBOR

LIMITED -38 FOOT PROJECT

U.S. ARMY ENGINEER DIST., SAN FRANCISCO, C OF E
DRAWN:
TRACED: TO ACCOMPANY REPORT
CHECKED: DATED
FILE NO.

FIGURE 2



REFERENCE SEDIMENT SAMPLING SITE NEAR
ALCATRAZ ISLAND ENVIRONS (R-AM)

SAN FRANCISCO COUNTY CALIFORNIA

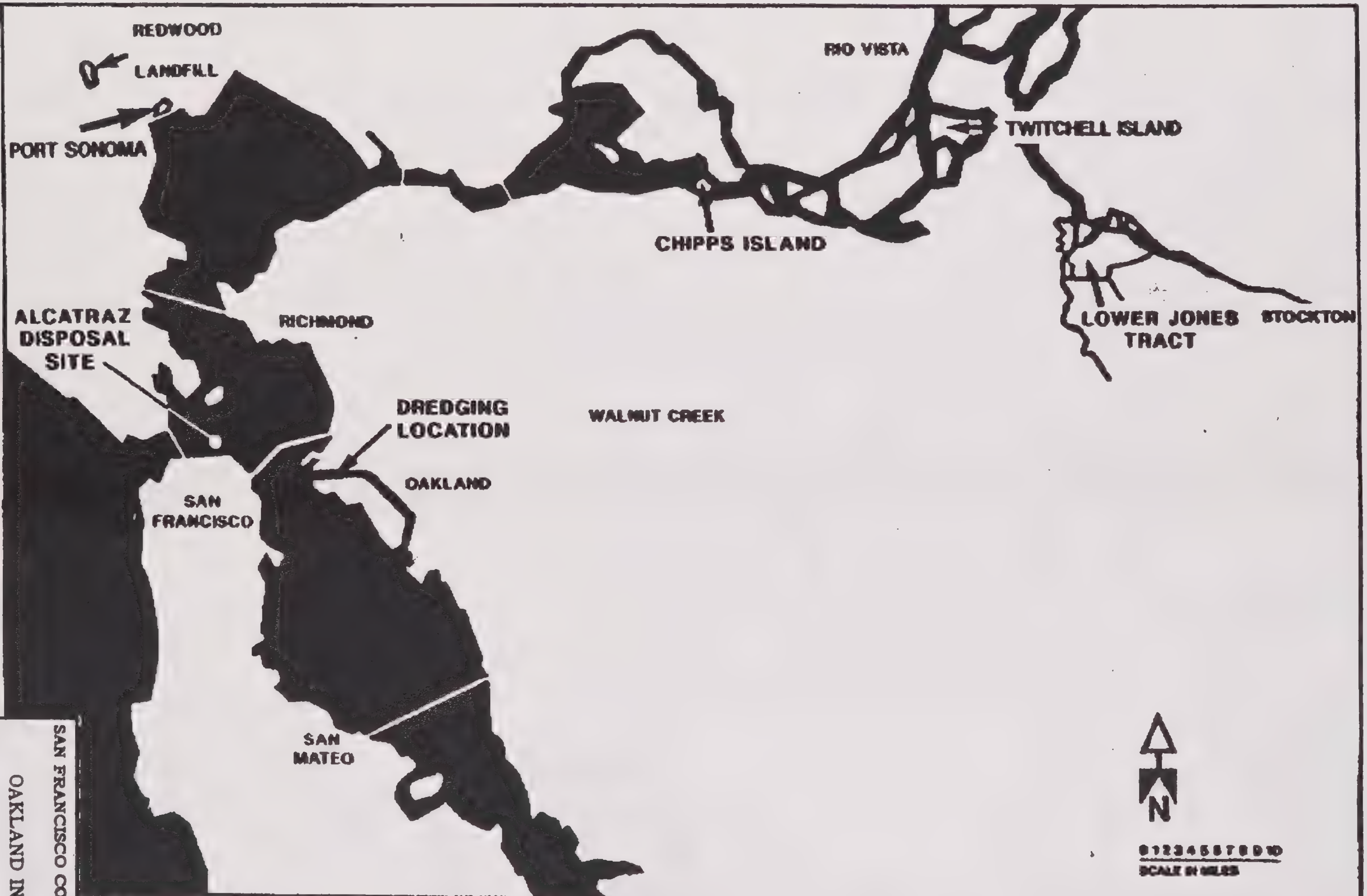
OAKLAND INNER HARBOR

LIMITED –38 FOOT PROJECT

U.S. ARMY ENGINEER DIST., SAN FRANCISCO, C OF E
DRAWN: FILE NO.
TRACED: TO ACCOMPANY REPORT
CHECKED: DATED

FIGURE 3

PORT SONOMA & REDWOOD LANDFILL SITES



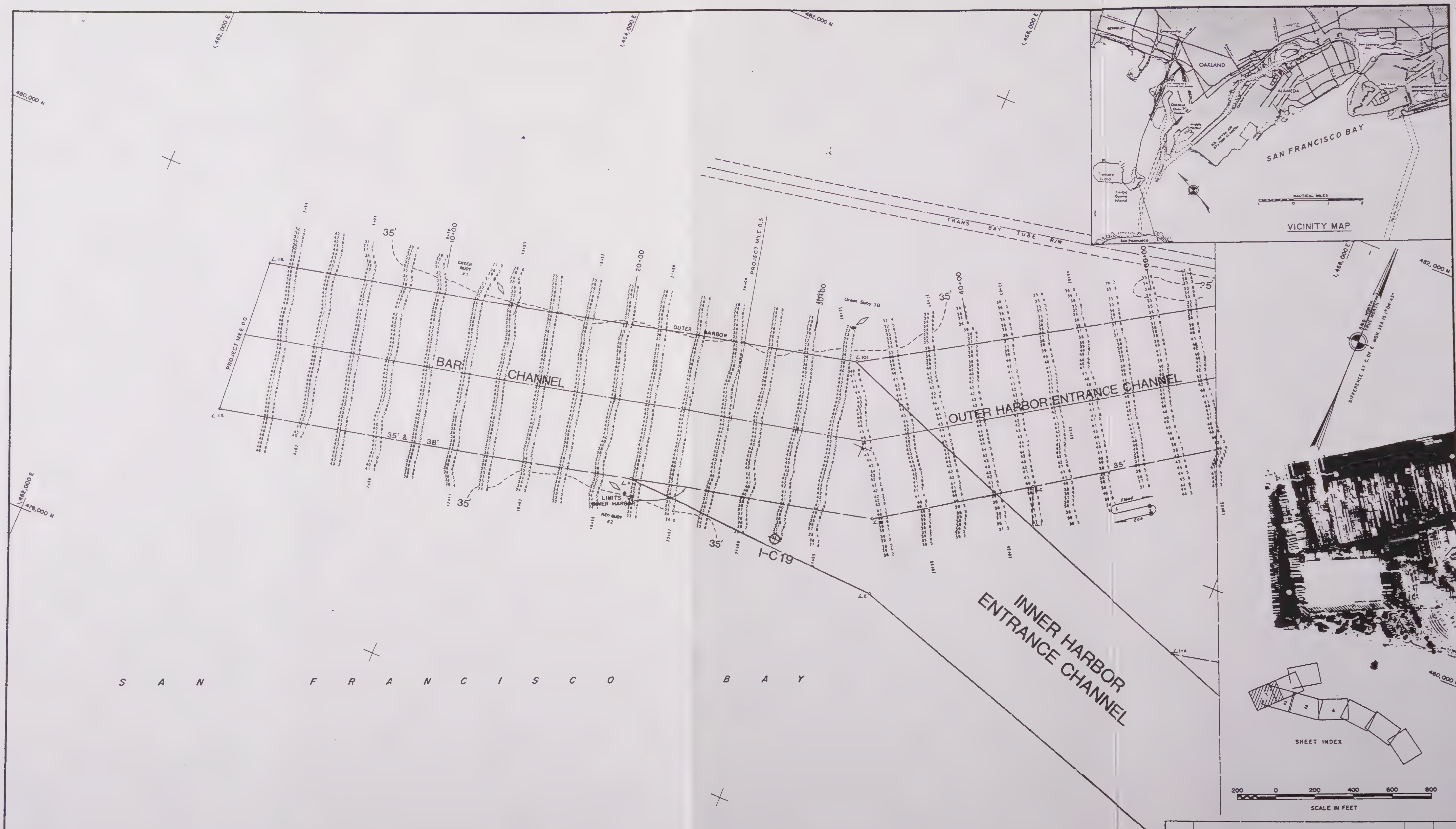
SAN FRANCISCO COUNTY CALIFORNIA

OAKLAND INNER HARBOR

LIMITED –38 FOOT PROJECT

U.S. ARMY ENGINEER DIST., SAN FRANCISCO, C OF E
DRAWN:
TRACED: TO ACCOMPANY REPORT FILE NO.
CHECKED: DATED

FIGURE 4



VERTICAL CONTROL			
LINES	BENCHMARK	MLLW	TIDE GAUGE LOCATION
[illegible] 96	RECEIVE RESET	12.16	YBI DOCK
	1970		
98 [illegible]	MOLE RM-1	12.37	PIER 7 (HL-18B)

HORIZONTAL CONTROL								
LINES	SURVEY POINT	NORTHING	EASTING	EL.	SURVEY POINT	NORTHING	EASTING	EL.

NOTES:
DRAWINGS NOT TO BE USED AS NAVIGATION CHARTS.
ONLY CHANNEL CONDITION AT DATE OF SURVEY.
THE LOCATION OF ALL NAVIGATION AIDS ARE BASED ON INFORMATION PROVIDED BY THE U.S. COAST GUARD.
BUOY LOCATIONS REPRESENT THE POSITION OF THE SINKER ONLY.
DATE OF PHOTOGRAPHY: AUG. 23, 1989.

LEGEND:

I-C2 Sampling Station Location

∠ NO.	LAMBERT COORDINATES	
	NORTH	EAST
101	480,389.11	1,465,771.22
115	478,890.06	1,462,746.94
116	479,696.31	1,462,695.27
8	479,663.90	1,466,182.71

NOTES:

SURVEYED BY THE CORPS OF ENGINEERS ON 19-22 & 26 NOVEMBER 1991

SOUNDINGS WERE TAKEN BY FATHOMETER AND ARE SHOWN TO THE NEAREST FOOT AND TENTHS OF A FOOT. ELEVATIONS ARE BASED ON MLLW DATUM.

1:00 INDICATES THE NUMBER AND BEGINNING OF A LINE OF SOUNDINGS. PLANE GRID, BEARINGS AND COORDINATES ARE BASED ON STATE OF CALIFORNIA COORDINATE SYSTEM (LAMBERT CONFORMAL PROJECT) ZONE III, CALIFORNIA, AS DESCRIBED IN SPECIAL PUBLICATION NO. 253. PUBLISHED BY THE NATIONAL OCEAN SURVEY.

PROJECT DEPTH OF OUTER HARBOR IS 35 FEET. PROJECT DEPTH OF INNER HARBOR TO PARK STREET BRIDGE IS 35 FEET TIDAL CANAL PROJECT DEPTH IS 25 FEET (MAINTAINED 18 FEET)

SYMBOL	DESCRIPTION	DATE	APPROVAL
REVISIONS			

PLATE EA-1

U. S. ARMY ENGINEER DISTRICT, SAN FRANCISCO
CORPS OF ENGINEERS
SAN FRANCISCO, CALIFORNIA

DRAWN BY:
TRACED BY:
CHECKED BY:
SUBMITTED:

ALAMEDA COUNTY CALIFORNIA

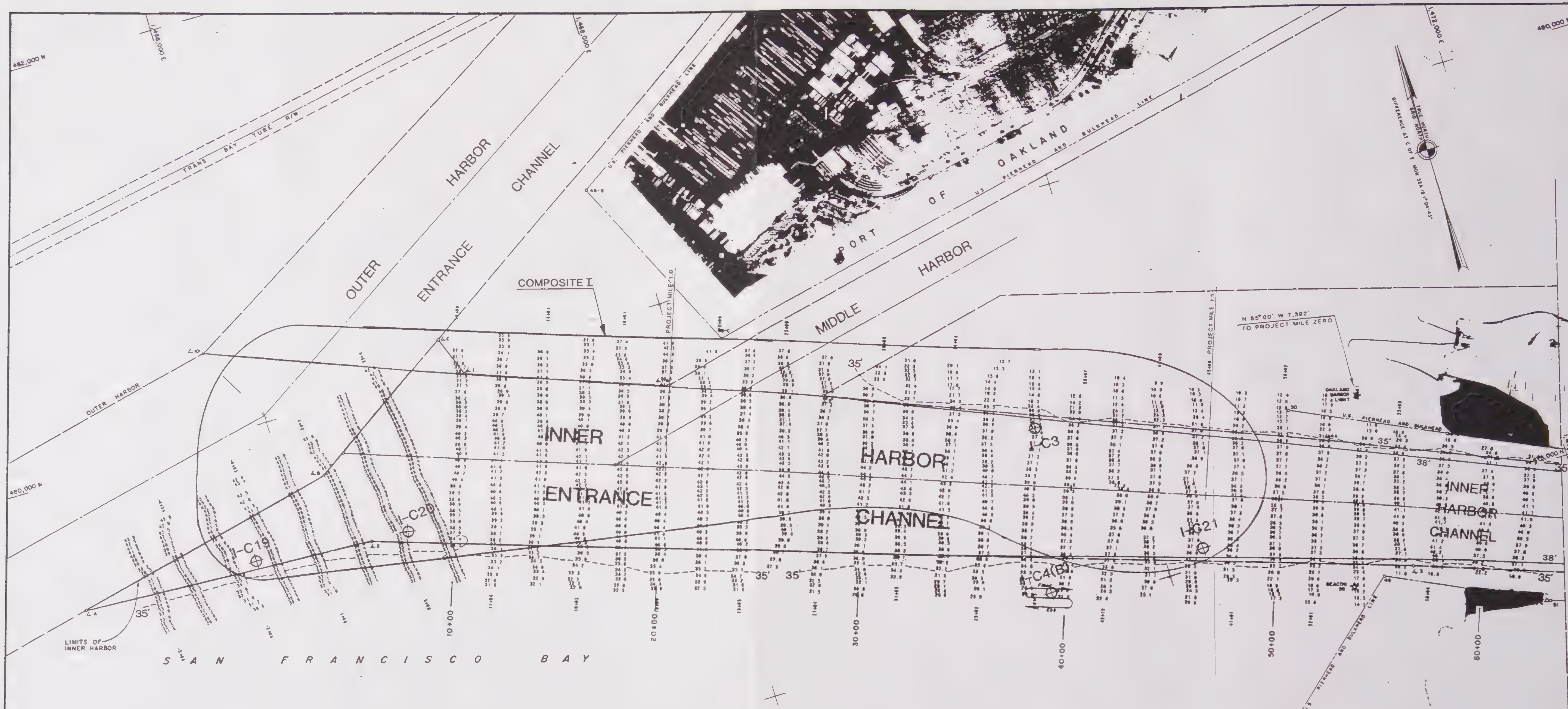
OAKLAND BAR & INNER HARBOR CHANNELS

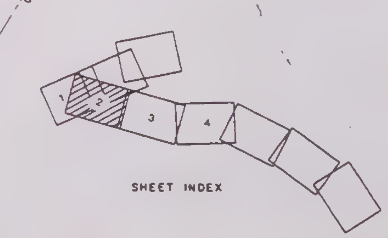
DEEPENING TO -38 FEET M.L.L.W.

DATE: 14 FEB 1992

PREPARED UNDER THE DIRECTION OF
STANLEY G. PHERNAMBUCO
LT. COLONEL, C.E., DISTRICT ENGINEER

SCALE:
JOB No.
DRAWING NUMBER
SHEET 1 OF 4 | 2 | 56 | 1





200 0 200 400 600 800

SCALE IN FEET

VERTICAL CONTROL			
LINES	BENCHMARK	MLLW	TIDE GAUGE LOCATION
-6 - 54	RECEIVE RESET	12 16	YBI CG DOCK
56 - 188	TIDAL 10	8 68	APL DOCK (RIGG)
190 - 240	PORT 2	11.26	MON END
242 - 336	GRAND/EWC	12 74	NEW RAMP

HORIZONTAL CONTROL								
LINES	SURVEY POINT	NORTHING	EASTING	EL	SURVEY POINT	NORTHING	EASTING	EL

LEGEND:

I-C2 Sampling Station Location

NOTES

SURVEYED BY THE CORPS OF ENGINEERS ON 19-22 & 26 NOVEMBER 1991

SOUNDINGS WERE TAKEN BY FATHOMETER AND ARE SHOWN TO THE NEAREST FOOT AND TENTHS OF A FOOT. ELEVATIONS ARE BASED ON MLLW DATUM

1 00 INDICATES THE NUMBER AND BEGINNING OF A LINE OF SOUNDINGS. PLANE GRID, BEARINGS AND COORDINATES ARE BASED ON STATE OF CALIFORNIA COORDINATE SYSTEM, (LAMBERT CONFORMAL PROJECT) ZONE III, CALIFORNIA, AS DESCRIBED IN SPECIAL PUBLICATION NO 253 PUBLISHED BY THE NATIONAL OCEAN SURVEY

PROJECT DEPTH OF OUTER HARBOR IS 35 FEET. PROJECT DEPTH OF INNER HARBOR TO PARK STREET BRIDGE IS 35 FEET. TIDAL CANAL PROJECT DEPTH IS 25 FEET (MAINTAINED 10 FEET)

∠ NO.	LAMBERT COORDINATES	
	NORTH	EAST
A	479,375.00	1,464,900.00
B	479,663.90	1,466,182.71
C	480,147.73	1,466,917.77
E	479,295.00	1,466,325.00
1	479,952.05	1,466,995.39
1-A	479,603.00	1,467,928.00
2	479,336.00	1,468,654.00
3	477,702.00	1,471,143.00
4-A	478,413.85	1,470,901.91

NOTES:

DRAWINGS NOT TO BE USED AS NAVIGATION CHARTS. ONLY CHANNEL CONDITION AT DATE OF SURVEY.

THE LOCATION OF ALL NAVIGATION AIDS ARE BASED ON INFORMATION PROVIDED BY THE U.S. COAST GUARD.

BUOY LOCATIONS REPRESENT THE POSITION OF THE SINKER ONLY.

DATE OF PHOTOGRAPHY: AUG. 23, 1989.

SYMBOL	DESCRIPTION	DATE	APPROVAL

REVISIONS

PLATE EA-2

U. S. ARMY ENGINEER DISTRICT, SAN FRANCISCO
CORPS OF ENGINEERS
SAN FRANCISCO, CALIFORNIA

DRAWN BY:
TRACED BY:
CHECKED BY:
SUBMITTED:

ALAMEDA COUNTY CALIFORNIA

OAKLAND BAR & INNER HARBOR CHANNELS

DEEPENING TO -38 FEET M.L.L.W.

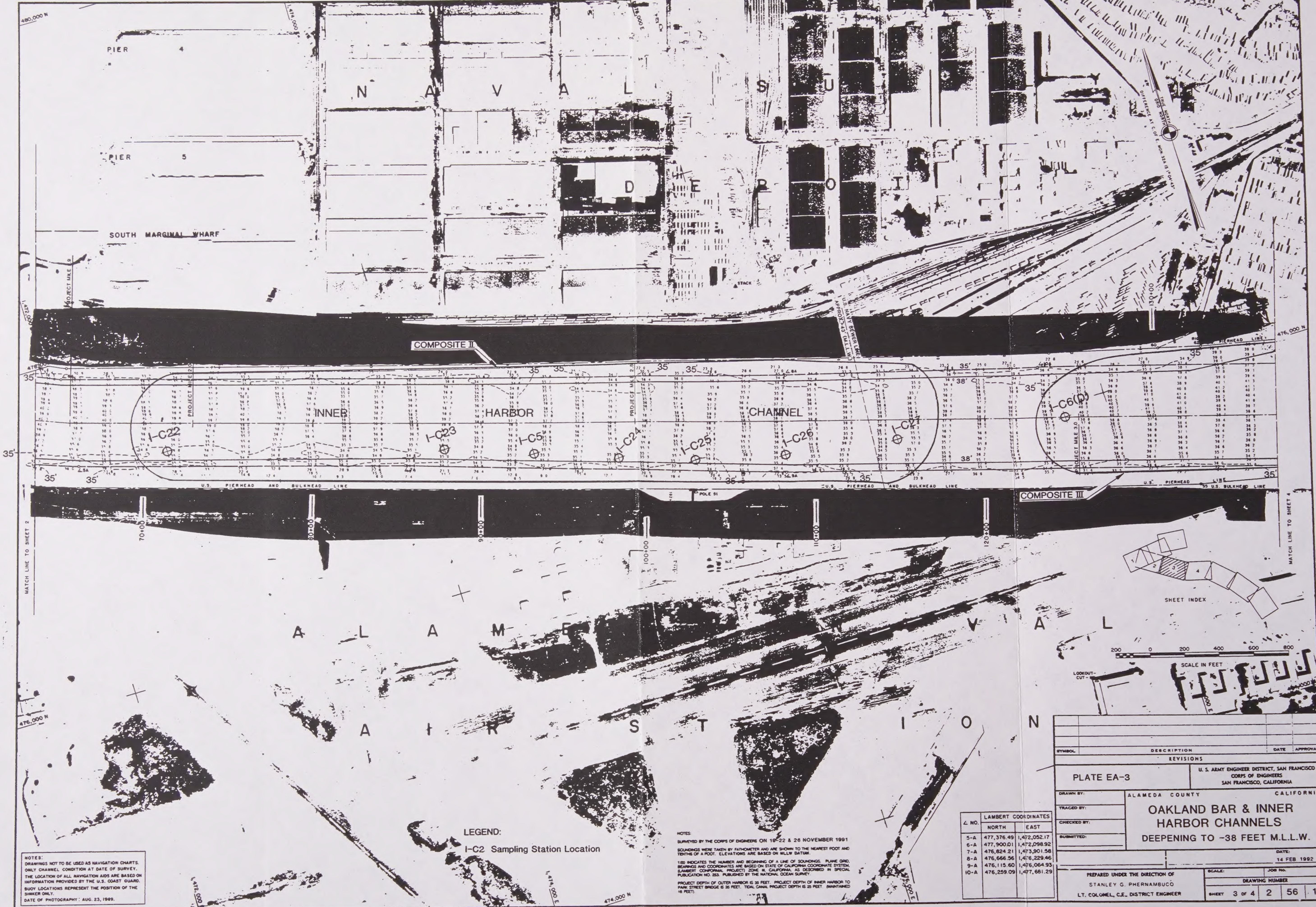
DATE: 14 FEB 1992

PREPARED UNDER THE DIRECTION OF
STANLEY G. PHERNAMBUCO
LT. COLONEL, C.E., DISTRICT ENGINEER

SCALE: JOB No.

DRAWING NUMBER

SHEET 2 OF 4 | 2 | 56 | 1



NOTES:

DRAWINGS NOT TO BE USED AS NAVIGATION CHARTS.

ONLY CHANNEL CONDITION AT DATE OF SURVEY.

THE LOCATION OF ALL NAVIGATION AIDS ARE BASED ON INFORMATION PROVIDED BY THE U.S. COAST GUARD.

BUOY LOCATIONS REPRESENT THE POSITION OF THE SINKER ONLY.

DATE OF PHOTOGRAPHY: AUG. 23, 1989.

LEGEND:

I-C2 Sampling Station Location

NOTES:

SURVEYED BY THE CORPS OF ENGINEERS ON 19-22 & 26 NOVEMBER 1991

SOUNDINGS WERE TAKEN BY FATHOMETER AND ARE SHOWN TO THE NEAREST FOOT AND TENTHS OF A FOOT. ELEVATIONS ARE BASED ON MLLW DATUM.

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∠ NO.	LAMBERT COORDINATES	
	NORTH	EAST
5-A	477,376.49	1,472,052.17
6-A	477,900.01	1,472,098.92
7-A	476,824.21	1,473,901.58
8-A	476,666.56	1,476,229.46
9-A	476,115.60	1,476,064.93
10-A	476,259.09	1,477,681.29

SYMBOL	DESCRIPTION	DATE	APPROVAL

REVISIONS

PLATE EA-3

U. S. ARMY ENGINEER DISTRICT, SAN FRANCISCO
CORPS OF ENGINEERS
SAN FRANCISCO, CALIFORNIA

DRAWN BY:
TRACED BY:
CHECKED BY:
SUBMITTED:

ALAMEDA COUNTY CALIFORNIA

OAKLAND BAR & INNER HARBOR CHANNELS
DEEPENING TO −38 FEET M.L.L.W.

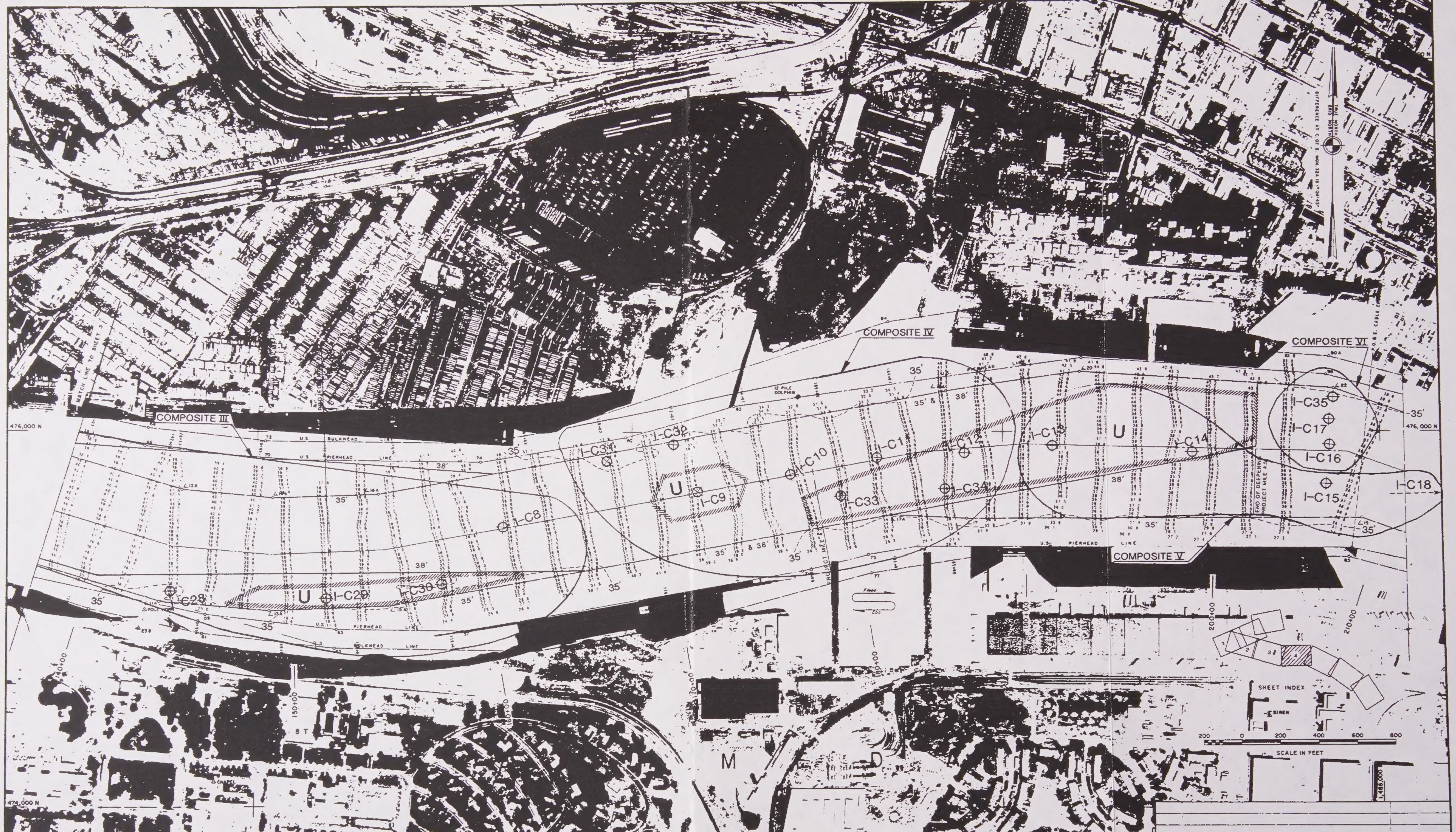
DATE: 14 FEB 1992

PREPARED UNDER THE DIRECTION OF
STANLEY G. PHERNAMBUCO
LT. COLONEL, C.E., DISTRICT ENGINEER

SCALE: JOB No.

DRAWING NUMBER

SHEET 3 OF 4 | 2 | 56 | 1



NOTES

SURVEYED BY THE CORPS OF ENGINEERS ON 19-22 & 26 NOVEMBER 1991.

SOUNDINGS WERE TAKEN BY FATHOMETER AND ARE SHOWN TO THE NEAREST FOOT AND TENTHS OF A FOOT. ELEVATIONS ARE BASED ON MLLW DATUM.

1 00 INDICATES THE NUMBER AND BEGINNING OF A LINE OF SOUNDINGS. PLANE GRID BEARINGS AND COORDINATES ARE BASED ON STATE OF CALIFORNIA COORDINATE SYSTEM (LAMBERT CONFORMAL PROJECT) ZONE III CALIFORNIA AS DESCRIBED IN SPECIAL PUBLICATION NO. 253 PUBLISHED BY THE NATIONAL OCEAN SURVEY.

PROJECT DEPTH OF OUTER HARBOR IS 35 FEET. PROJECT DEPTH OF INNER HARBOR TO PARK STREET BRIDGE IS 35 FEET. TIDAL CANAL PROJECT DEPTH IS 25 FEET. (MAINTAINED 18 FEET)

LEGEND:

I-C2 Sampling Station Location

U = Unsuitable For Aquatic Disposal

NOTES

DRAWINGS NOT TO BE USED AS NAVIGATION CHARTS. ONLY CHANNEL CONDITION AT DATE OF SURVEY.

THE LOCATION OF ALL NAVIGATION AIDS ARE BASED ON INFORMATION PROVIDED BY THE U.S. COAST GUARD.

BUOY LOCATIONS REPRESENT THE POSITION OF THE SINKER ONLY.

DATE OF PHOTOGRAPHY: AUG. 23, 1989.

∠ NO.	LAMBERT COORDINATES	
	NORTH	EAST
11-A	475,094.00	1,479,486.00
12-A	475,686.82	1,479,597.67
13-A	475,046.36	1,480,064.04
14-A	475,647.27	1,480,077.68
15-A	475,069.99	1,480,705.06
16-A	475,667.78	1,480,639.19
17	475,540.00	1,483,810.00
17-A	475,556.55	1,483,404.48
18	476,254.79	1,483,950.47
18-A	476,218.74	1,483,695.56
19	475,533.00	1,485,898.00
20	476,320.60	1,484,415.84
22	476,219.99	1,485,758.73

SYMBOL	DESCRIPTION	DATE	APPROVAL

REVISIONS

PLATE EA-4

U. S. ARMY ENGINEER DISTRICT, SAN FRANCISCO
CORPS OF ENGINEERS
SAN FRANCISCO, CALIFORNIA

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